INSTRUCTION MANUAL

S-BAND TEST ANTENNA SYSTEM

RADIATION
Melbourne
A Division of Radiation Incorporated

Project No. 6620

INSTRUCTION MANUAL

This ... performed for the Jet Propulsion Laboratory, Califo... ...titute of Technology, sponsored by the National Aeronautics and Space Administration under Contract NAS7-100.

S-BAND TEST ANTENNA SYSTEM

for
Deep Space Instrumentation Facility
of
Jet Propulsion Laboratory
California Institute of Technology
Contract No. 950268

February, 1963

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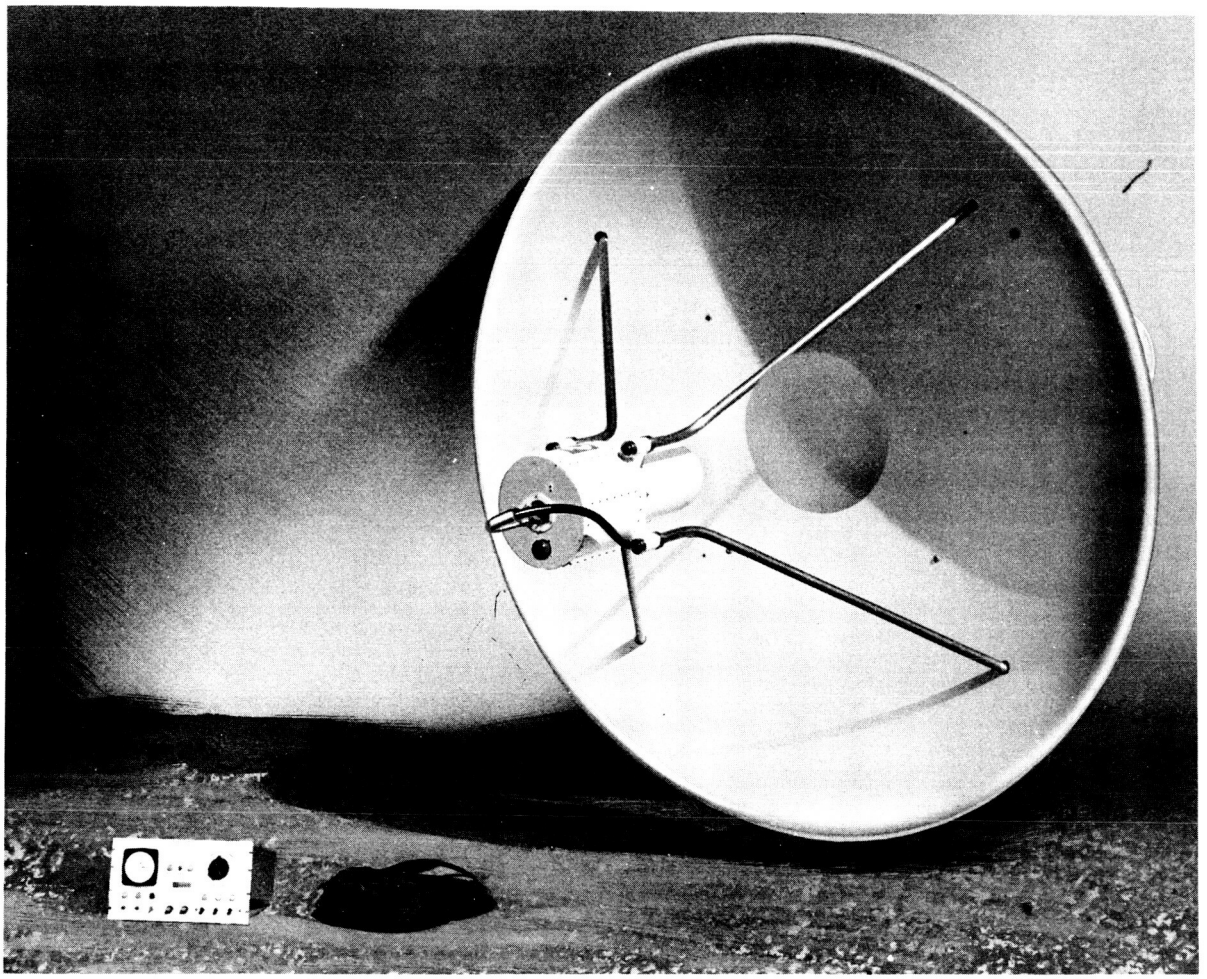
INTRODUCTION

This handbook furnishes information and instructions for installation, operation, and maintenance of S-Band Test Antennas (refer to frontispiece) supplied to Jet Propulsion Laboratory, Pasadena, California, under Contract No. 950268.



Frontispiece S- Band Test Antenna System

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SECTION I

GENERAL DESCRIPTION

1.1 PURPOSE OF EQUIPMENT

The S-Band Test Antenna provides the capability to make patterns, gain and ellipticity measurements on the Deep Space Instrumentation Facility (DSIF) antennas and provides a means of testing the closed loop characteristics of a complete S-Band tracking system within the frequency ranges 2113 ±10 mc and 2295 ±10 mc in accordance with JPL Specification No. 8005.

1.2 EQUIPMENT SUPPLIED

The S-Band Test Antenna system consist of:

a) Eight foot parabolic reflector assembly (1, Figure 1).

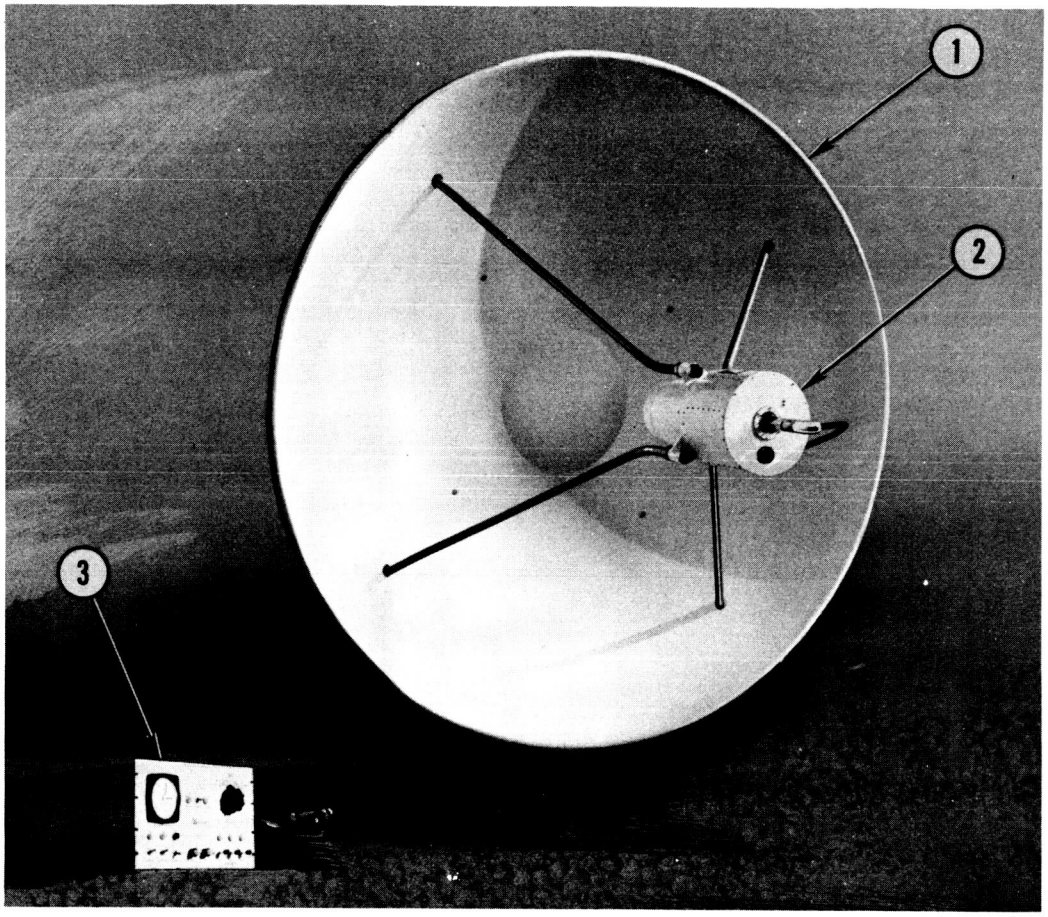
b) Circular aperture feed system (2, Figure 1).

c) Control Panel (3, Figure 1).

1.3 DESCRIPTION

The reflector assembly consists of a reflector measuring eight foot in diameter with an f/d ratio (focal length to diameter) of 0.375, a mounting structure which provides a plus and minus five degrees adjustment in both azimuth and elevation, an optical boresight telescope with protective housing, and a spare and horn ring structure and feed support.

The feed system consists of a dipole and coaxial rotary joint with a 7/8 inch coax output, an iris section which acts as a polarization transducer, a drive motor for changing and orienting polarizations, two synchro-transformers (one (1) - 1 to 1 gear ratio and one (1) - 36 to 1 ratio), and logic switches for control and read-out of polarization changes. The feed system also includes a weather-proof housing and radome.



1 - PARABOLIC REFLECTOR

2 - FEED UNIT

3 - CONTROL PANEL

Figure 1 S- Band Test Antenna

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The control panel consists of a 19 inches x 10.5 inches panel with operating controls and a dial indicator for polarization orientation read-out, a power supply, motor speed control, and 150 feet of connecting control cable.

1.4 SYSTEM PERFORMANCE CHARACTERISTICS

The S-Band antenna has the following performance characteristics:

Frequency	- 2113 ±10 mc and 2295 ±10 mc.
VSWR	- Less than 1.2 to 1 over the specified frequency bands.
Polarization	- Rotatable linear and both right and left circular.
Ellipticity	- No greater than 1 db over the specified frequency bands for right or left circular polarization.
Gain	- 31 db or greater over the specified frequency bands, relative to an isotropic radiator.
Gain Variation	- Less than ±0.1 db as a function of feed rotation at either of the specified frequencies.
Cross Polarization	- Cross-polarized component will be at least 20 db down within one degree of the peak of the main beam.
Side Lobe Level	- 20 db down for any polarization over the specified frequency bands.
Beamwidth	- Less than 4.5 degrees at the half power points.
Power Capacity	- 100 watts CW power for any polarization and any frequency within the specified bands.

SECTION II

THEORY OF OPERATION

2.1 R-F OPERATION

R-F energy is fed into the 7/8-inch coaxial input and is converted into TE_{11} mode inside the circular waveguide by means of the dipole transition. The linear TE_{11} mode is then fed into the polarization transducer to produce either rotatable linear, right circular, or left circular polarization.

To obtain linear polarization, the dipole input is aligned parallel to the irises of the polarization transducer as indicated in Figure 2. By locking the dipole input in this position relative to the irises and rotating the entire feed, the linear polarization may be rotated continuously.

For circular polarization, the irises are set at 45 degrees to the dipole (Figure 2). This allows the incident vector to be converted into two equal magnitude, orthogonal vectors, one of which is advanced in time while the other is delayed. The total time phase difference between these two vectors is made 90 degrees by the geometry of the polarization transducer over the frequency range 2103 mc to 2305 mc. Hence, the radiated energy is circularly polarized.

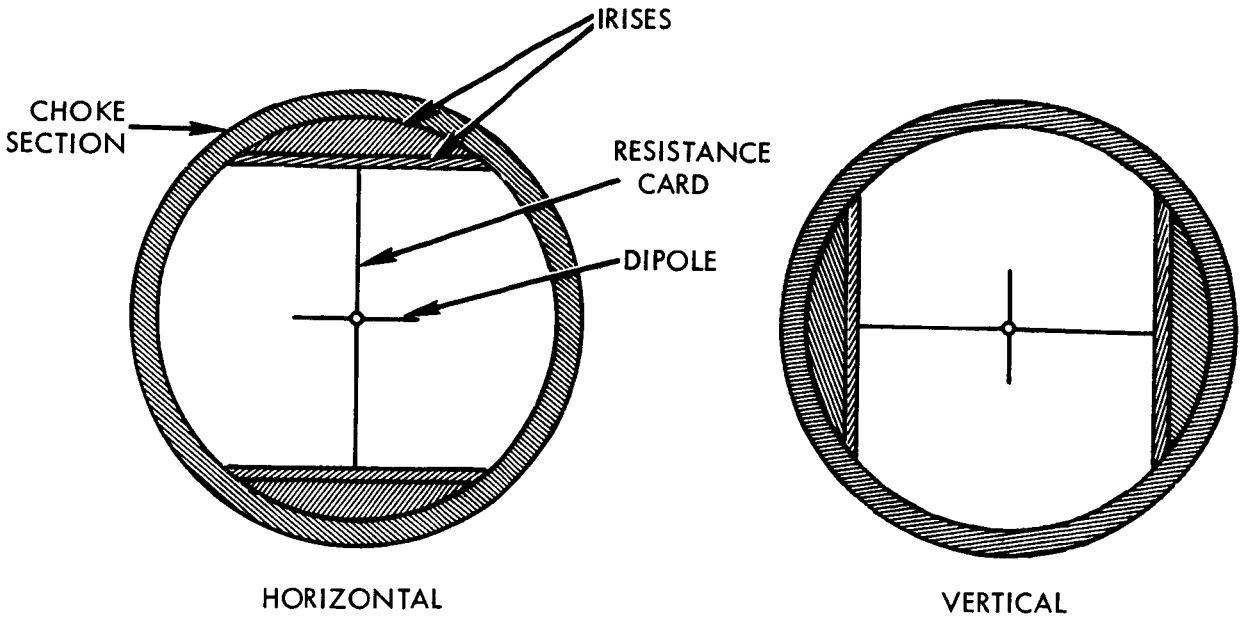
Either right circular or left circular polarization (Figure 2) may be obtained depending on the orientation of the irises with respect to the dipole.

2.2.1 Antenna Feed (Figure 3)

2.2.1.1 Rotating Linear Polarization

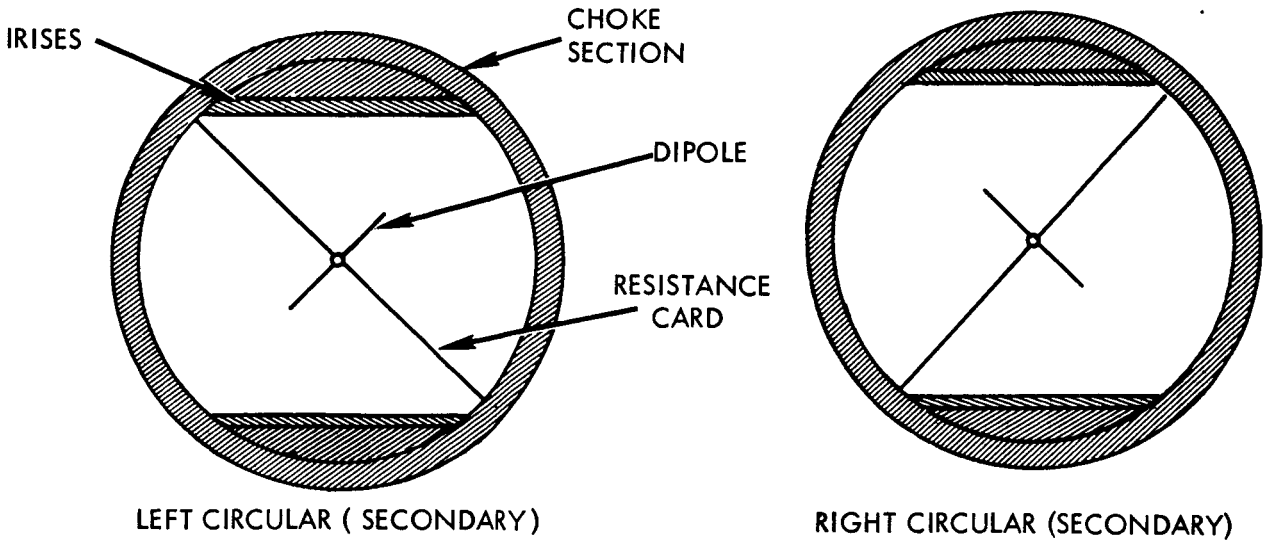
To achieve rotating linear polarization, the entire waveguide section of the antenna feed is revolved about the reflector mechanical axis. The speed and direction of rotation is determined by a Variac-controlled dc power supply on the control panel. This power supply feeds a reversible dc motor which drives the waveguide section through a gear train. Coarse and fine synchros are also geared to the waveguide and drive position readouts on the control panel.

In the linear mode, the polarization transducer (iris section) and the dipole section of the waveguide rotate as a unit. They are coupled by means of a pair of mechanical ball detents.



NOTE: VIEWED FROM RADOME END OF FEED

DETAIL A



NOTE: VIEWED FROM RADOME END OF FEED

DETAIL B

Figure 2 Linear and Circular Polarization

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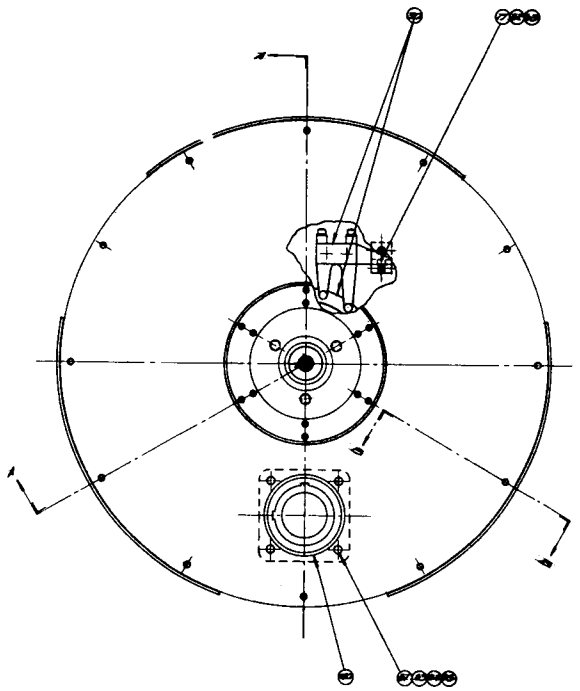
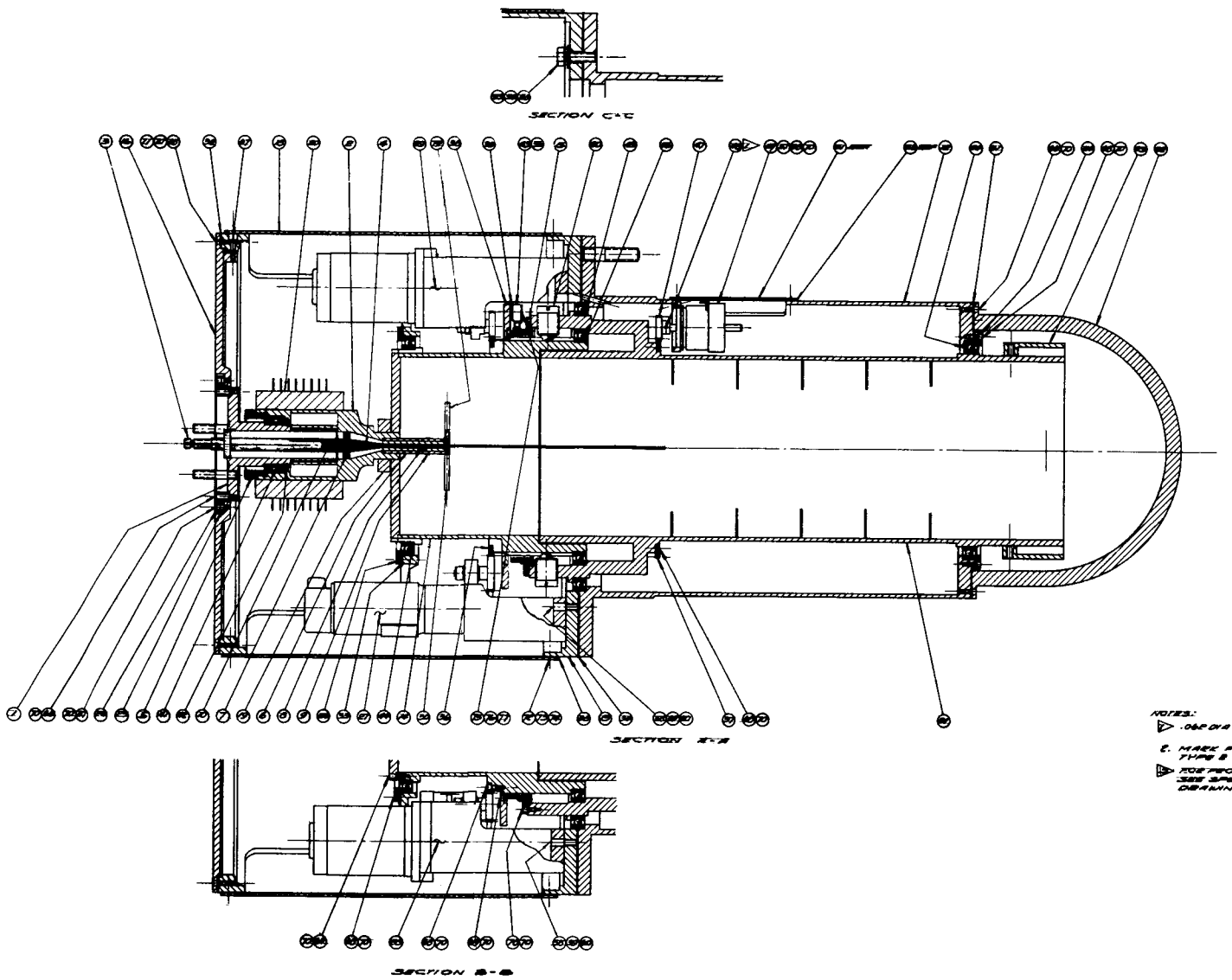
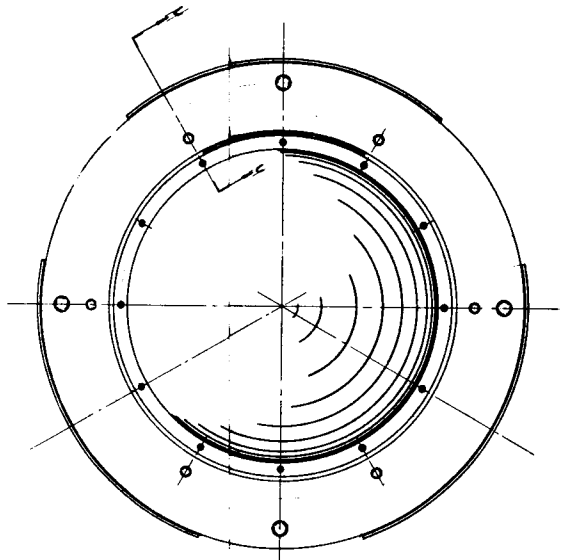




NOTES:
▷ .062 DIA AT ASSEMBLY
C. MARK PER MIL-STD-130-900108 TYPE II CLASS A1
▷ FOR PROCUREMENT OF PART NO. SEE SPECIFICATION CONTROL DRAWING



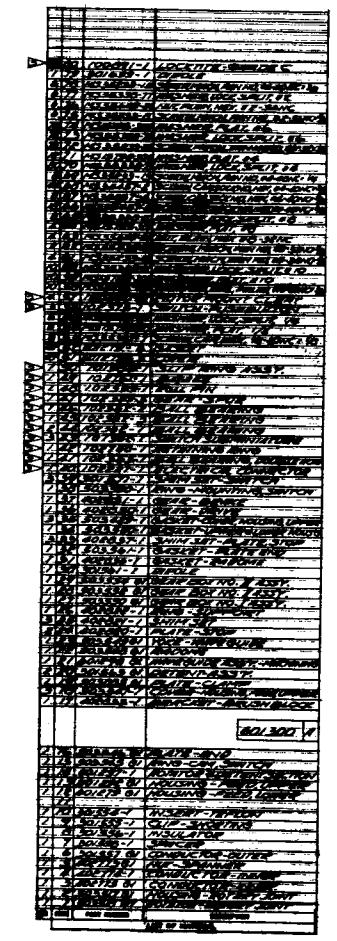


Figure 3 S- Band Test Antenna, Feed Unit, Assembly

2.2.1.2 Circular Polarization

As explained in paragraph 2.1 and shown in Figure 2, circular polarization is achieved by rotating the dipole 45-degrees with respect to the iris section. Left circular is achieved by orienting the dipole in one 45-degree plane, right circular in the other. The mechanisms required to accomplish this rotation remotely are:

a) Electromagnetic Brake

b) Detent Device

c) Limit Switch System

d) Slip Ring Assembly

e) Remote Display

The brake is geared to the iris section and "free-wheels" during rotation in the linear mode. When changing polarization, a voltage is applied to the brake which locks the iris section to the housing. This condition is sustained until the desired position is reached, at which time the brake is released.

The detent device holds the iris section and the dipole section in the proper orientation for all modes of operation. A pair of detent slits are provided for left circular, right circular, or linear polarization. To change from one polarization position to another, the motor drives the dipole section in normal manner except that the brake prevents the iris section from turning. The braking action cams the detent ball out of the slot. The ball rolls along the perimeter of the waveguide and then drops into the next slot. When the slot corresponds to the polarization position desired, the motor and the brake are de-energized and all motion stops. When the detent slot is incorrect, the ball rolls through the slot and continues on to the correct slot for the desired polarization.

The limit switches are cam operated and are synchronized with the detent mechanism. They are used to turn the motor and brake off when the desired position is reached. In addition, they are used to operate indicator lights on the control panel which verifies that the desired position has been reached.

A slip ring assembly is required to provide continuity because the limit switches are mounted on a rotating element. The assembly is mounted on the dipole section.

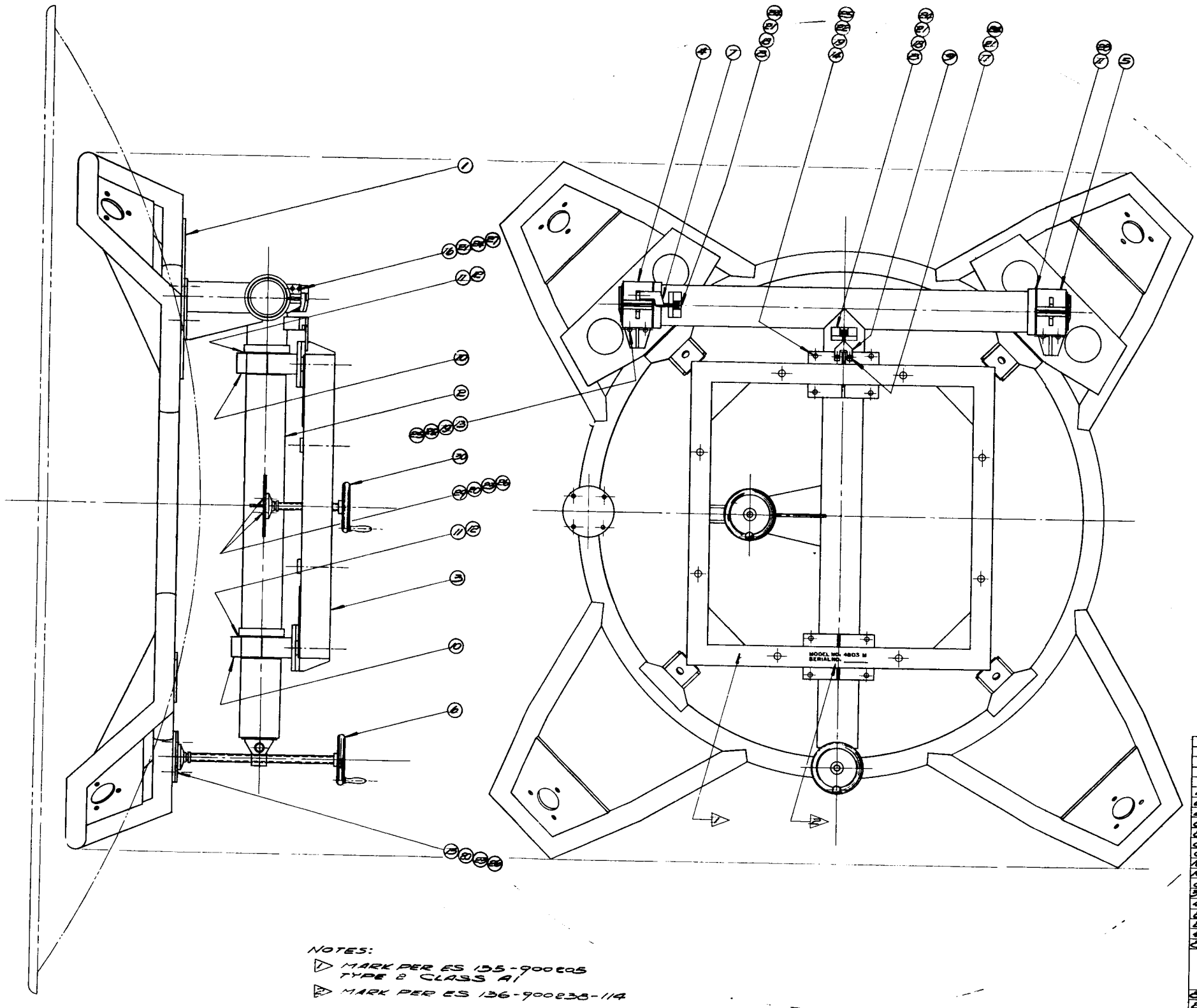
The polarization display on the control panel consists of three neon lamps, one for each position. Below each lamp is a pushbutton corresponding to that position. The lamps are actuated by the limit switches mentioned above.

Since the synchros are geared to the dipole section, the readout will indicate rotation when the polarization mode is changed. This rotation has no significance in the POLARIZATION mode, but the readout will always indicate the linear polarization angle in the ROTATION mode. The rotation indicated on the readout will not always be 45 degrees, because the motor drives in only one direction when changing modes. Thus, to change from one mode to another it is sometimes necessary to rotate to 45, 90, or 135 degrees.

2.2.2 Antenna Mount (Figure 4)

The antenna mount must be fastened to a surface that is normal to the line of sight within plus or minus five degrees. Azimuth and elevation handcrank adjustments are provided for boresighting within the five degree range. In addition, dials are provided on both axes to insure repeatability in pointing the reflector. Each scale division on the dials represents one degree.

A boresight telescope is also provided for collimating the antenna. The optical axis of the telescope has been oriented parallel to the electrical axis of the antenna, and is locked in that position. The telescope is mounted in a weatherproof tube which has transparent windows in each end. Once the telescope has been focused to the viewer's satisfaction, it should not be necessary to remove the end cover, except for maintenance. The recommended eye position for viewing is approximately one inch from the window in the end cover.



NOTES:
▷ MARK PER ES 135-900005 TYPE 8 CLASS A1
▷ MARK PER ES 136-900638-114

ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT
1	30	503894 ⑥	ADJUSTMENT SCREW ASSY, AZ
4	23	MS35457-37	SCREW, CAP, SOCKET HEAD, HEX
6	28	301429-5	LINING-BEARING, TEFLON
2	27	MS35649-36	NUT, PLAIN, HEX, MACH SCREW
0	26	MS35649-46	NUT, PLAIN, HEX
0	25	MS35650-406	NUT, PLAIN, HEX
0	24	MS35338-42	WASHER, LOCK, SPLIT
0	22	MS35338-43	WASHER, LOCK, SPLIT
18	21	MS35338-47	WASHER, LOCK, SPLIT
10	31	MS35795-37	WASHER, FLAT
0	30	MS15795-840	WASHER, FLAT
32	29	MS15795-845	WASHER, FLAT
4	16	MS35461-8	SCREW, CAP, SOCKET HEAD HEX
0	17	MS35033-41	SCREW, MACH., PAN HEAD
2	16	MS35033-40	SCREW, MACH., PAN HEAD
4	15	MS35305-7	SCREW, CAP, HEX HEAD
0	14	MS35303-46	SCREW, CAP, HEX HEAD
			601158 ⑦
0	13	MS35303-46	SCREW, CAP, HEX HEAD
2	12	301429-1	LINING-BEARING, TEFLON
4	11	301428-1	WASHER-THRUST, TEFLON
2	10	504005 ⑥	BLOCK-PILLOW
1	9	400892-1	INDICATOR-VERTICAL
2	8	400893 ⑥	BLOCK-DIAL
1	7	400891-1	INDICATOR-HORIZONTAL
1	6	504000 ⑥	ADJUSTMENT SCREW ASSY, EL
1	5	504001 ⑥	BRACKET-HANGER, EL M.
1	4	504001 ⑥	BRACKET-HANGER, EL M.
1	3	601157 ⑥	FRAME-MOUNTING
1	2	601156 ⑥	FRAME-PIVOT
1	1	601155 ⑥	SUPPORT STRUCTURE-MAIN

Figure 4 S- Band Test Antenna, Antenna Mount, Assembly

SECTION III

INSTALLATION

3.1 ANTENNA SUBSYSTEM INSTALLATION (Figure 5)

The antenna subsystem has been completely assembled and adjusted prior to shipment and is ready for immediate installation. The subsystem mounts to its interface by means of eight 5/8-11NC2 bolts of suitable length. Eight equally spaced mounting holes are provided around the square frame at the rear of the structure.

CAUTION

Care should be taken during installation that the RG253/u, one-half inch coax cable is not flexed in a bend radius less than five inches, particularly at the point where it enters the spar.

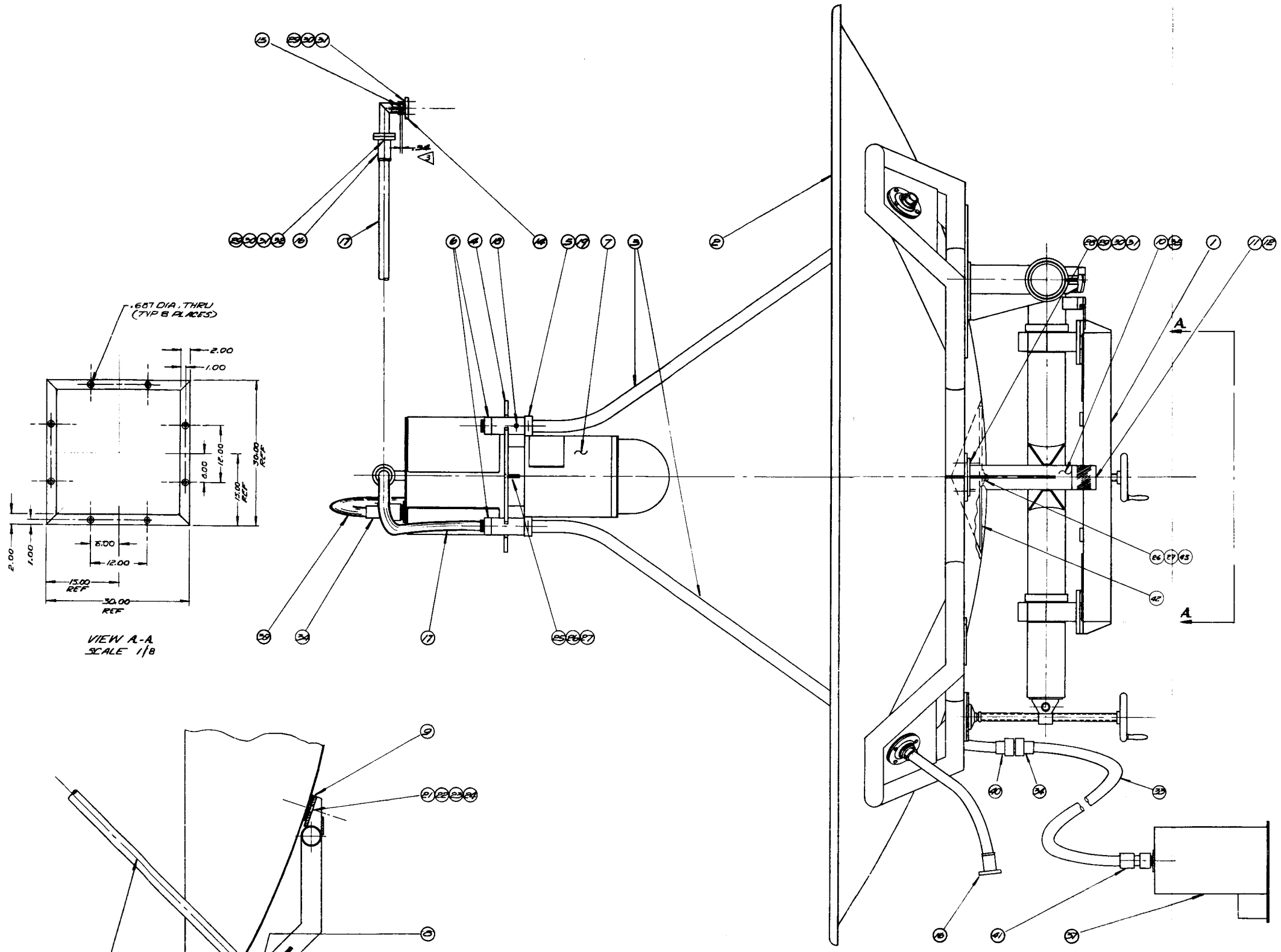
3.1.1 Boresighting (Figures 6 and 7)

The boresight telescope has been aligned with the reflector electrical axis at assembly and is locked in place. To collimate the test antenna with the antenna under measurement, the telescope crosshairs must be aligned with the center of the 85-foot reflector. The correction for parallax is 21 inches to the viewer's left.

To adjust the test antenna, first loosen the jam nuts (3 and 5, Figure 6) on the handcrank lead screws. Then the reflector can be positioned by turning the handcranks (2 and 4, Figure 6). To reset the antenna at a previously determined position, refer to the indicator dials on the azimuth (1, Figure 7) and elevation (2, Figure 7) axes. Each scale division on these dials represents one degree of angular change. Once antenna is in the desired position, the jam nuts on the handcrank leadscrews must be tightened. The jam nuts eliminate the backlash in the handcrank leadscrew threads.

3.2 ANTENNA FEED INSTALLATION

The antenna feed is installed, aligned, and focused prior to shipment, and should be left in the test antenna during installation. If necessary to remove or replace the feed, perform the following steps as outlined in paragraphs 3.2.2, 3.2.3 and 3.2.4.



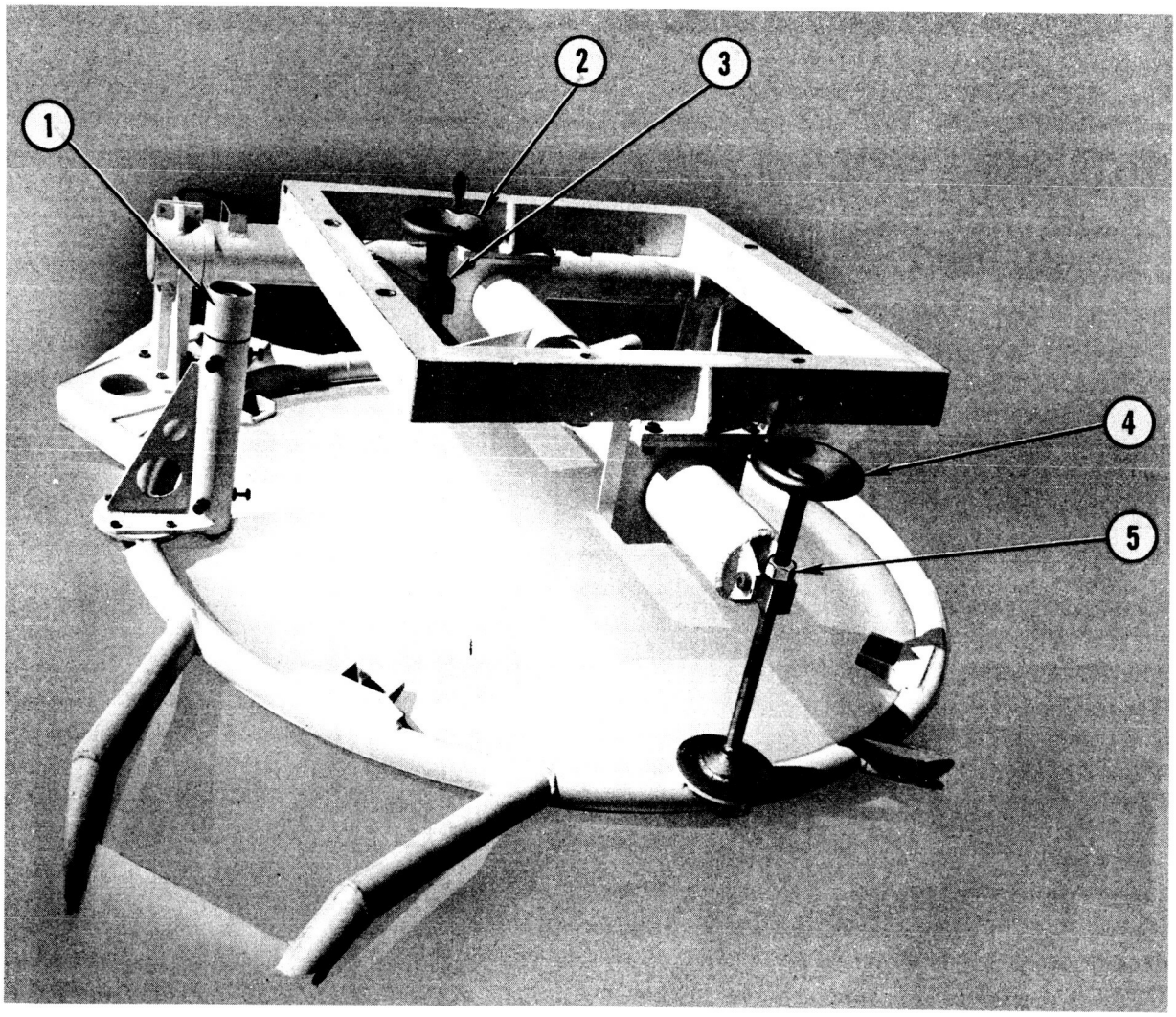
VIEW A-A
SCALE 1/8

TYPICAL SECTION SHOWING MOUNTING OF ITEM (E) & (3)

ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT
1	43	MS35307-58	SCR, MACH, HEX HD, 3/8-16 UNC x 3/8
1	42	SOA5701G1	ENERGY DISPERSION CONE
1	41	MS3106R16-10S	CONNECTOR
1	40	1082R6-2	ELEC. CONNECTOR
1	39	101986-1	CONTROL CABLE
AR	38	100891-1	SEALANT, LOCTITE, GRADE C
1	37	601397 G1	PANEL, CONTROL
4	36	301701-1	COLLAR - SPAR
1	35	1076R4-1	TELESCOPE SIGHT
2	34	1082R6-1	ELECTRICAL CONNECTOR
(10)	33	101986-1	CONTROL CABLE
3	32	MS35303-9	SCREW, CAP, HEX HD, 1/8-20 UNC x 1 1/8 LG
(6)	31	MS35330-44	WASHER, LOCK, SPLIT, 1/4
2	30	MS15795-210	WASHER, FLAT, 1/4
2	29	MS35690-402	NUT, PLAIN, HEX, 1/4
2	28	MS35303-8	SCREW, CAP, HEX HD, 1/4-20 UNC x 7/8
5	27	MS35338-46	WASHER, LOCK, SPLIT, 3/8
5	26	MS15795-416	WASHER, FLAT, 3/8
4	25	MS35690-602	NUT, PLAIN, HEX, 3/8-16 UNC
4	24	MS35338-50	WASHER, LOCK, SPLIT, 5/8
4	23	MS15795-820	WASHER, FLAT, 5/8
4	22	MS35690-1005	NUT, PLAIN, HEX, 5/8-11 UNC
4	21	102731-6	SCR, MACH, ED HD, SOC, HEX 40 PLATED
(6)	20	MS51034-51	SET SCREW, HEX, SOCKET, CONE POINT
4	19	MS35436-13	SCREW, CAP, SOCKET HD, HEX 10-32 UNF
2	18	MS17660	PIN, SPRING
(10)	17	102945-1	CABLE, R-F
2	16	102944-1	CONNECTOR
1	15	301944-1	RING - MATCHING
1	14	102802E-1	7/8 - 50 Ohm 90° BEND
			601322 REV A
4	13	403236-1	ADAPTER - MOUNTING, SPAR
1	12	MS29775-236	SEAL "O" RING
1	11	403032 G1	COVER - HOUSING, TELESCOPE SIGHT
1	10	503603 G1	HOUSING - TELESCOPE SIGHT
4	9	301588-1	PAD - RUBBER
4	8	301647-1	SET COLLAR
1	7	601300 G1	FEED ASSEMBLY
4	6	301478-1	NUT - RING
4	5	403033-1	CLAMP - SPAR
1	4	504008 G1	RING - HORN
4	3	504003-1	SPAR - FEED
1	2	503689-1	SMT - PARABOLIC REFLECTOR
1	1	601150 G1	PARABOLIC REFLECTOR MOUNT ASSY

LIST OF MATERIALS OR PARTS LIST

Figure 5 S- Band Test Antenna, Assembly



1 - BORESIGHT TELESCOPE HOUSING

2 - AZIMUTH HANDCRANK

3 - JAM NUT

4 - ELEVATION HANDCRANK

5 - JAM NUT

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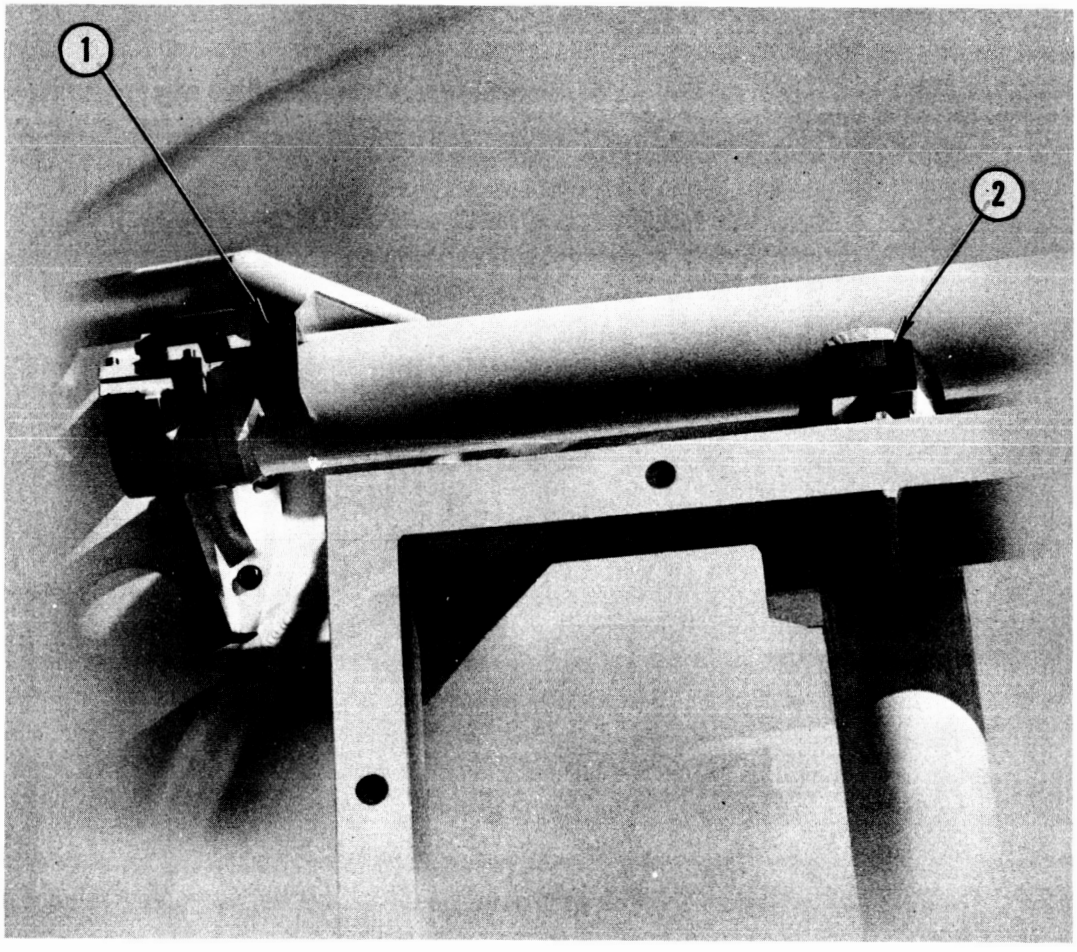
Figure 6 S- Band Test Antenna, Bottom Rear Oblique View



1 - ELEVATION INDICATOR DIAL

2 - AZIMUTH INDICATOR DIAL

Figure 7. S-Band Test Antenna, Azimuth and Elevation Indicators, Partial Left Top View

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3.2.2 Cable Disconnect

Disconnect the control cable connector at the rear of the feed. Attach the protection caps to the free end of the cable and the feed connector.

It is recommended that the RF cable be disconnected from the 7/8-inch EIA, 90-degree elbow at the feed.

CAUTION

Special care should be taken in disconnecting the RF cable to avoid further bending of the cable at the point where it enters the spar. The recommended procedure is to rotate the cable until adequate clearance for removal of the feed is obtained.

NOTE

Should the EIA elbow be disconnected at the feed, the center conductor of the rotary joint will come out with the elbow. During the change-over exercise care that the center connector is not lost and protect the free end of the RF cable and feed flange from environment and foreign matter.

3.2.3 Feed Removal

The feed is held in place by four 3/8 hex nuts which are located on the reflector side of the horn ring. When the nuts are removed, the feed is free to slip out of the horn ring, away from the reflector.

CAUTION

Care must be taken not to scrape the radome against the horn ring during this operation as protective finish may be damaged. This could result in harmful deterioration due to moisture penetration.

3.2.4 Reassembly

Replacing the feed is essentially the reverse procedure to that as described in paragraphs 3.2.2 and 3.2.3. Alignment or focusing is not necessary, as the horn ring orients the feed as it is bolted down.

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Note

Original alignment was accomplished by adjusting the horn ring with respect to the reflector, after which the horn ring was pinned in place. These pins must not be removed, as they are required for rotational stability.

3.3 CONTROL PANEL

The control panel has been checked out with the feed unit at RADIATION INCORPORATED. Inspect the unit carefully for signs of physical damage. If unit appears satisfactory, connect the control cable between the "MS" jack (located at the rear of the control panel) and the Pyle-National jack (Located at the rear of the antenna). Place all power switches on the control panel in the OFF position. Connect the power cable to a 115 volt, 60 cycle, single phase power source. The control panel is ready for operation as instructed in Section IV, Operating Instructions.

If control panels are interchanged between units, the indicator synchros must be realigned for accurate readout. The synchros have been aligned at RADIATION INCORPORATED with the matched reflector and feed assembly for correct readout.

SECTION IV

OPERATING INSTRUCTIONS

4.1 GENERAL

This section provides instructions necessary to operate the S-Band Test Antenna. The antenna must not be operated unless the feed unit, control panel, and interconnecting control cable have been installed as directed in Section III, Installation. Refer at the first occurrence of a malfunction, during the operating procedure, to the instructions given in Section V, Maintenance.

Figure 8 is provided to illustrate the location of all controls and indicators used during normal operation of the equipment. Table 1 lists the controls and indicators, presents a brief functional description on each, and provides adequate circuit and figure reference.

4.2 OPERATING PROCEDURE

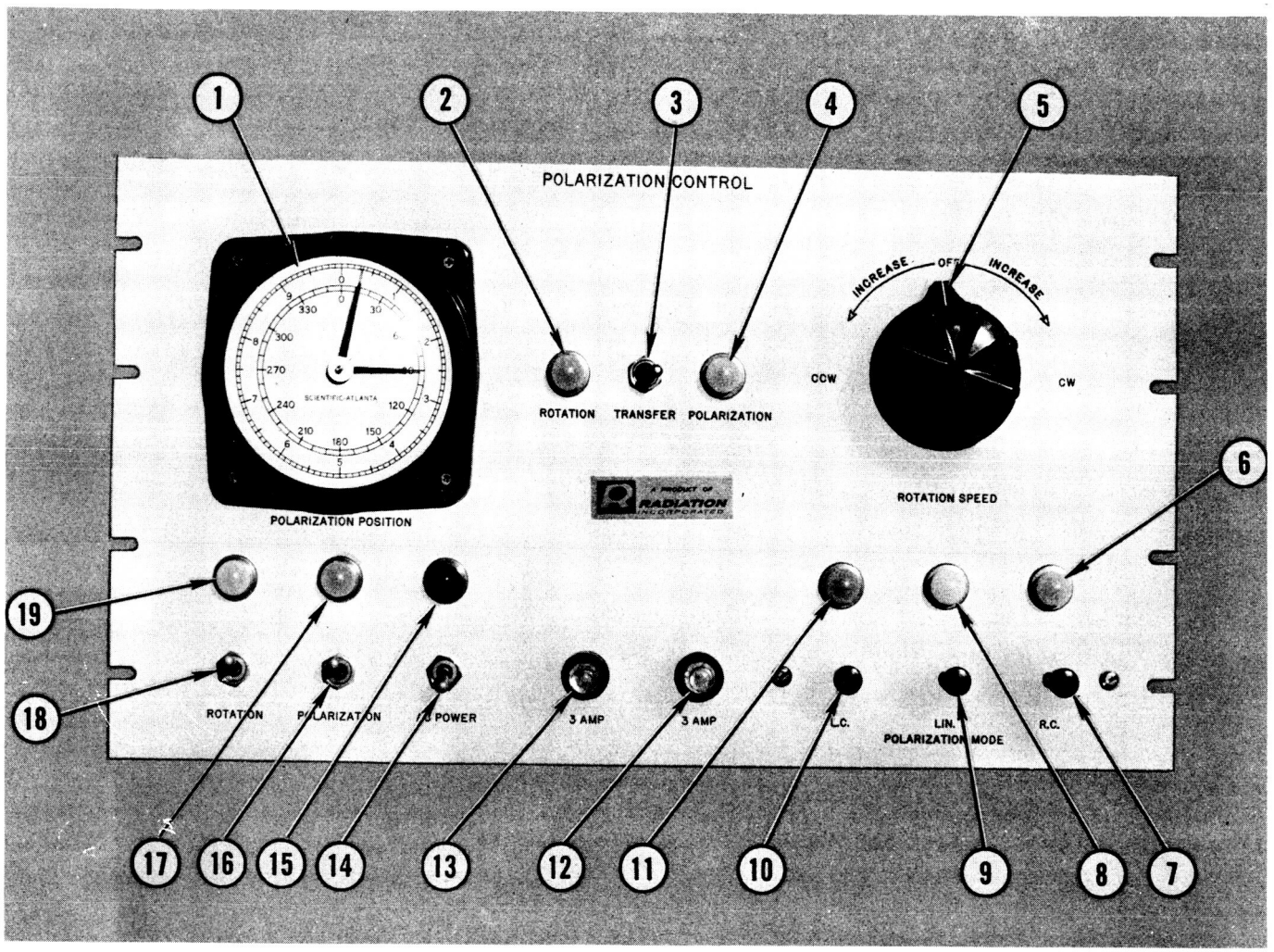
Perform the following procedure step-by-step, in the order presented, without omission until conclusion.

1. Make sure all POWER (14, 16, and 18 Figure 8) switches are OFF.

2. Connect control panel power cable to a 115 volts, 60 cps, single phase source (three prong receptacle).

3. Set AC POWER (14) switch S4 to ON and observe pilot lamp (15) DS 5 above switch lights.

4. Set TRANSFER (3) switch S1 to ROTATION and observe that POLARIZATION POSITION (1) dial M1 indicates 0° (vertical linear polarization) and ROTATION indicator lamp (2) DS1 lights.



1 - POLARIZATION POSITION INDICATOR M1

2 - ROTATION LAMP DS1

3 - TRANSFER SWITCH S1

4 - POLARIZATION LAMP DS2

5 - ROTATION SPEED CONTROL T1

6 - POLARIZATION MODE/R.C. LAMP DS8

7 - POLARIZATION MODE/R.C. SWITCH S5C

8 - POLARIZATION MODE/LIN. LAMP DS7

9 - POLARIZATION MODE/LIN. SWITCH S5B

10 - POLARIZATION MODE/L.C. SWITCH S5A

11 - POLARIZATION MODE/L.C. LAMP DS6

12 - 5 AMP BLOWN FUSE INDICATOR F2

13 - 5 AMP BLOWN FUSE INDICATOR F1

14 - AC POWER SWITCH S4

15 - AC POWER LAMP DS5

16 - POLARIZATION SWITCH S3

17 - POLARIZATION POWER LAMP DS4

18 - ROTATION SWITCH S2

19 - ROTATION POWER LAMP DS3

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Figure 8 Control Panel, Front View

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TABLE I
Location and Function of Controls and Indicators

Circuit Reference Designator	Name	Function	Figure and Reference
DS1	ROTATION indicator lamp.	Indicates when S1 is set to ROTATION position.	2, Figure 8
DS2	POLARIZATION indicator lamp	Lights to indicate when S1 is set to POLARIZATION position.	4, Figure 8
DS3	ROTATION Power indicator lamp	Lights to indicate when S2 is on.	19, Figure 8
DS4	POLARIZATION Power indicator lamp	Lights to indicate when S3 is on.	17, Figure 8
DS5	AC POWER indicator lamp	Lights to indicate when S4 is on.	15, Figure 8
DS6	POLARIZATION MODE /LC indicator lamp	Lights when S5A is activated and antenna is cycled to left circular polarization.	11, Figure 8
DS7	POLARIZATION MODE /LIN indicator lamp	Lights to indicate that S5B is activated and antenna is cycled to linear polarization.	8, Figure 8
DS8	POLARIZATION MODE /RC indicator lamp	Lights to indicate that S5C is activated and antenna is cycled to right circular polarization.	6, Figure 8
F1 & F2	5 AMP fuses	Overload circuit protectors which glow when fuse is opened.	12 and 13, Figure 8

TABLE I
Location and Function of Controls and Indicators (Continued)

Circuit Reference Designator	Name	Function	Figure and Reference
M1	POLARIZATION POSITION dial	Indicates polarization angles from 0° to 360°.	1, Figure 8
S1	TRANSFER switch	Used to select between ROTATION and POLARIZATION.	3, Figure 4-1
S2	ROTATION POWER switch	Provider power to antenna polarization rotation circuits through ROTATION SPEED control T1.	18, Figure 4-1
S3	POLARIZATION POWER switch	Provider power to circuits that change polarization mode through pushbutton switches POLARIZATION/LC/LIN/RC,S5A through S5C.	16, Figure 4-1
S4	AC POWER switch	Provides main ac power input to S-band test antenna circuits.	14, Figure 4-1
S5A	POLARIZATION/LC switch	Provides means to change antenna mode to left circular polarization.	10, Figure 4-1
S5B	POLARIZATION/LIN switch	Provides means to change antenna mode to linear polarization.	9, Figure 4-1

TABLE I
Location and Function of Controls and Indicators (Continued)

Circuit Reference Designator	Name	Function	Figure and Reference
S5C	POLARIZATION/RC switch	Provides means to change antenna mode to right circular polarization.	7, Figure 4-1
T1	ROTATION SPEED control	Affords means of controlling antenna speed and direction.	5, Figure 4-1

Note

0 degrees indication in step 4 is an indication that the feed unit has not been disturbed from the RADIATION INCORPORATED setting.

5. In order to change polarization modes, set TRANSFER switch S1 to POLARIZATION, observe POLARIZATION indicator lamp (4) DS2 lights, and set POLARIZATION power (16) switch S3 to ON. Observe that corresponding indicator lamp (17) DS4, above switch S3, is lighted.

6. Depress POLARIZATION MODE/LC pushbutton (10) switch S5A to change antenna mode to left circular polarization. Indicate lamp (11) DS6, above S5A, will light when antenna feed unit has cycled to left circular mode.

7. Depress POLARIZATION MODE/RC pushbutton (7) switch S5C to change antenna mode to right circular polarization. Indicator lamp (6) DS8, above S5C, will light when antenna feed unit has cycled to right circular mode.

Note

The POLARIZATION POSITION dial M1 will normally continue to indicate angular positions during any mode. Only the linear mode of operation makes use of the POLARIZATION POSITION dial M1 for accurate angular reference.

8. In order to return to linear mode, depress POLARIZATION MODE/LIN pushbutton (9) switch S5B and observe that indicator lamp (8) DS7, above S5B, lights. Unlighted condition indicates polarization cycle is still in process. Lamp lights when the feed unit has stopped cycling and is in linear polarization. In linear mode, POLARIZATION POSITION dial M1 indicates vertical linear polarization at angles of 0 degrees or 180 degrees. Indications of 90 degrees or 270 degrees denote horizontal linear polarization.

CAUTION

Pushbuttons on this unit are designed to function one at a time. Should one jam,do not force. Check for cause and remedy, as serious damage to equipment could result.

9. To rotate linear polarization make sure that feed is in linear mode (refer to step 8) and perform the following:

   a. Set TRANSFER switch S1 to ROTATION, observe DS1 lights.

   b. Set ROTATION power (18) switch S2 to ON, observe (19) DS3 lights.

   c. Slowly turn ROTATION SPEED control (5) T1 toward INCREASE CW, observe LINEAR POSITION dial M1 indicates clockwise angular change.

   d. Slowly turn ROTATION SPEED control T1 counter-clockwise past OFF toward INCREASE CCW, observe LINEAR POSITION dial M1 counter-clockwise angular change.

Note One

When ROTATION SPEED control T1 is operated at maximum CW or CCW position, antenna speed will be five rpm approximately.

Note Two

The direction of rotation, CW or CCW, as indicated on LINEAR POSITION dial M1 represents the direction of the linear vector rotation (as viewed from behind the antenna).

   e. Set ROTATION SPEED control T1 to OFF.

10. Set AC POWER switch S4 to OFF and observe that all lamps are extinguished. This step constitutes equipment turn-off.

SECTION V

MAINTENANCE

5.1 GENERAL

The S-Band Test Antenna System has been engineered to provide troublefree service for at least 2000 hours of operational life. Listed below is a procedure that is recommended to maintain design operation:

5.1.1 Mount Maintenance (Figure 9)

The antenna mount is fabricated from aluminum, stainless steel, and cadmium plated steel parts and therefore do not depend on paint for protection.

5.1.1.1 Feed Support (2, Figure 9)

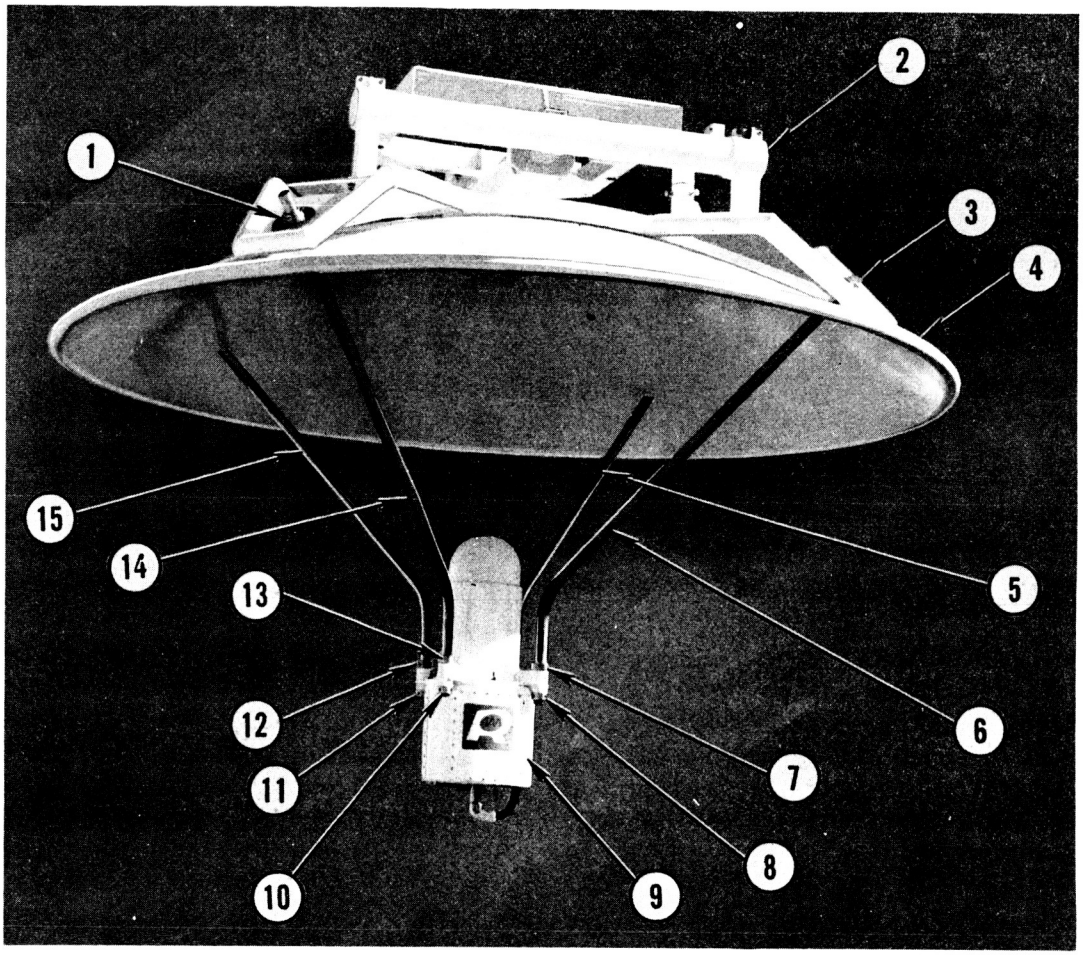
Inspect and check the feed support and horn ring subassembly semi-annually to insure all hardware is tight. Direct special attention to the clamping collars at the base of each spar as play in this area will cause undesirable flexibility at the feed.

5.1.1.2 Azimuth and Elevation Handcranks (2 and 4, Figure 6)

Inspect and check the jam nuts on the handcrank leadscrews semi-annually to insure they are snug in place. Excessive backlash on the leadscrews due to loose jam nuts will affect mount stability and degrade the performance of the subsystem.

5.1.1.3 Boresight Telescope (1, Figure 6)

The boresight telescope is provided with a small container of dessicant crystals inside the protective tube to prevent the viewing windows in the tube from fogging. Remove end cover from the protective tube and replace with rejuvenated or new dessicant at least once each month, or following extreme humidity or moisture conditions.



1-, 3-, 7-, 8-, 10- THRU 13- CLAMPING COLLARS

2 - MOUNT

4 - PARABOLIC REFLECTOR

5-, 6-, 14-, 15 - FEED SUPPORTS

9 - FEED UNIT

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Figure 9 S- Band Test Antenna, Top View

5.1.2 Feed Maintenance

Perform the following:

5.1.2.1 Slip Rings

Clean the slip ring assembly as required with Trichloroethylene.

5.1.2.2 Gear Trains

All gears in the feed have been lubricated with Lubri-Plate at RADIATION INCORPORATED and further lubrication is unnecessary.

If necessary to remove any of the gear packages clean and lubricate them with Lubri-Plate prior to assembly. Set backlash on gear train within the range of 0.005 to 0.010-inch by moving the gear assembly with respect to the mounting base.

5.1.2.3 Detent Mechanisms

The two detent mechanisms in each feed are located opposite each other at the large end of the waveguide iris section. Each consists of a stainless steel housing, a stainless steel spring, a bronze plunger, and a stainless steel ball. All of these parts are lubricated with Lubri-Plate. To remove the detent mechanism, rotate the iris section until the detent is directly on the bottom. Remove detent ball. Removal of detent in any other iris position will result in difficulty of removing the ball.

Note

Before re-installing the detent, make sure the air hole in the end of the detent housing is unobstructed.

5.1.2.4 Moisture Protection

A container of dessicant crystals has been placed inside the feed mechanism at assembly. It is there to keep the inside of the feed as dry as possible. However, due to the inaccessibility of the feed, it is inadvisable to attempt to change the dessicant at regular intervals.

CAUTION

The feed housing has been tightly sealed, and should not be opened unless necessary.

If it is required to remove any of the access covers, dry out or exchange the dessicant as a routine measure. To insure a tight fit between the access cover and the housing, the gasket should be replaced each time it is removed and coated with an appropriate gasket cement.

5.1.3 Control Assembly Maintenance

Perform the following:

1. Replace any indicator lamps which fail in use.

2. Clean and relubricate the sliding surfaces of the mode selector pushbutton switches with a light coat of Lubri-Plate every six months.

3. Check the relay contacts every six month and, if necessary, burnish.

4. Check and polish the brush contact surface of the polarization rotation auto-transformer with crocus cloth every six months. If necessary replace the contact brush.

5.1.4 Troubleshooting (Figure 10)

a. The following test equipment is required to perform maintenance and troubleshooting.

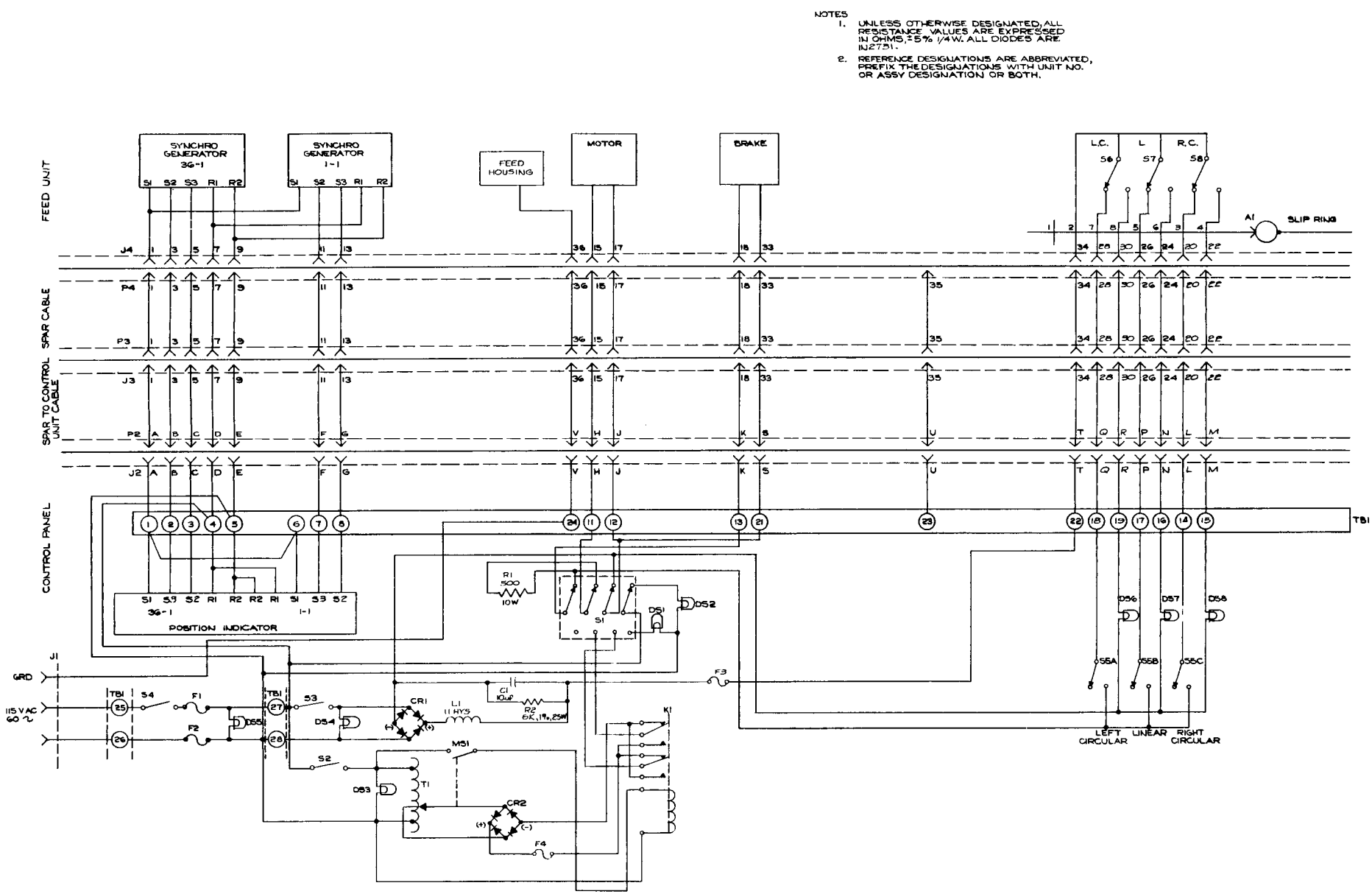

Figure 10 S- Band Test Antenna, Schematic

1. Simpson Model 260 VOM meter or equal.

2. 1 - 2000 ohm, 10 watt resistor with Pyle-National pins attached to the leads so that it can be connected to J2 (MS jack) on the rear of the control panel as a substitute for the feed drive motor.

3. 1 - 2000 ohm, 10 watt resistor with Pyle-National pins attached to the leads so that it can be connected to the J2 (MS jack) on the rear of the control panel as a substitute for the feed drive brake.

(b) Check the following before beginning the troubleshooting procedure outlined in paragraphs 5.1.4.1 through 5.1.4.5.

1. Make sure the 115 volt power cord is disconnected from the unit before proceeding to item 2.

2. No change.

3. Reconnect the power cord to 115 volt, 60 cps, single phase power source and make sure the fuses are good before commencing to troubleshoot.

4. No change.

5.1.4.1 Voltage Test of Control Unit

Perform the following:

1. Rotation

   a. Set switches to OFF position.

   b. Plug 2000 ohm, 10 watt resistor into pins H and J of J2 (MS jack).

   c. With ROTATION SPEED control to center position, connect voltmeter across resistor, set voltmeter to 250 vdc scale.

d. Turn AC POWER and rotation power switches to ON and TRANSFER switch to ROTATION.

e. Turn ROTATION SPEED control either direction from center position and voltage rises to 120 volts approximately with polarity of voltage changing according to direction of rotation. If no voltage is present, check rectifier and speed control transformer. If polarity of voltage doesn't change, check operation of relay. Relay will energize as speed control is moved through OFF position. If relay is not energized, check operation of microswitch and cam on speed control transformer, cam operates microswitch just as speed control passes through OFF position.

5.1.4.2 Polarization Drive Motor and Brake Power

a. Set switches in OFF position.

b. Plug one 2000 ohm, 10 watt resistor into pins H and J, other 2000 ohm, 10 watt resistor into pins K and S, and jumper pins T and Q at MS jack (J2).

c. Connect voltmeter set to 250 vdc range, across resistor connected between pins H and J of MS jack J2 with the negative lead on the connection to pin J of J2.

d. With TRANSFER switch in POLARIZATION position, turn AC POWER and POLARIZATION POWER to ON and LC (left circular) switch depressed, voltmeter reads approximately 120 volts. If not, check rectifier and switches. This checks the power for the polarization drive motor when in left circular mode.

e. Repeat steps c and d except use resistor connected between pins K and S of J2. This checks the power for the polarization brake when in the LEFT CIRCULAR mode.

f. Remove jumper from J2 pin Q and connect it to J2 pin Q. Repeat the above steps a through e with the RIGHT CIRCULAR switch depressed. This checks the power for the polarization drive motor and brake when in the RIGHT CIRCULAR mode.

g. Remove jumper from J2 pin L and connect it to J2 pin P. Repeat steps a through e with LINEAR switch depressed. This checks the power for the polarization drive motor and brake when in the LINEAR mode.

5.1.4.3 AC Power for the Indicator Unit

a. Use voltmeter to measure 115 vac between terminals R1 and R2 at both synchro motors.

5.1.4.4 AC Power for the Synchro Transmitters in the Feed Unit

a. Use voltmeter to measure 115 vac between pins D and E at J2.

5.1.4.5 Voltage Test of Feed Unit - Control System

Control unit is assumed to be normal and is operating; perform the following:

5.1.4.5.1 Voltage Check of Synchro Generators

a. Connect all inter-connecting control cables.

b. At Control Unit turn AC POWER to ON.

c. With VOM meter connected between R1 and R2 of either synchro generator the voltage reads 115 vac. If voltage is not present, check ac power source and cables.

d. With VOM meter connected between any pair of S leads on either synchro generator, voltage reads between 0 and 90 vac according to the angular position of synchro generator rotor. When rotating portion of feed is rotated, voltage varies from 0 to 90 vac. If voltage is not present, check synchro generators for defective S windings.

5.1.4.5.2 Motor Check

a. Connect all inter-connecting control cables.

b. At Control Unit turn AC POWER to ON.

c. Apply power to motor.

d. Connect VOM meter across motor and measure dc voltage. Voltage varies between 0 and 120 v and polarity of voltage changes according to setting of motor SPEED CONTROL.

e. If voltage is not present at motor, check inter-connecting cables. If voltage is present and motor does not turn, check motor for defects; repair and/or replace motor if defective.

5.1.4.5.3 Brake and Microswitch Check.

a. Make sure all inter-connecting cables are connected.

b. Jumper slip ring brushes 2 and 7.

c. Depress LEFT CIRCULAR switch on Control Unit.

d. Apply POLARIZATION POWER to unit.

e. The brake is continuously energized and motor is continuously driving polarization changing mechanism.

f. If brake does not hold, check brake terminals for a dc voltage of 120 volts approximately. If voltage is not present, check inter-connecting cables.

5.1.4.5.4 Polarization Positioning Switches

a. Disconnect control cable.

b. With left circular limit switch off, cam VOM meter reads continuity between slip rings 2 and 7. With left circular limit switch on, cam VOM meter reads continuity between slip rings 2 and 8. If abnormal, check switch for damage and replace as required. If switch is normal, check physical position and re-adjust as necessary.

c. Check linear switch in same manner as for left circular limit switch, except check continuity between slip rings 2 to 5 and 2 to 6 .. Remedy is same as 4-b above.

d. Check right circular limit switch in same manner as for left circular limit switch, except check continuity between slip rings 2 to 3 and 2 to 4 . Remedy is same as 4-b above.

SECTION VI

SYSTEM PERFORMANCE TESTS

6.1 GENERAL

Section VI contains the necessary instructions to test the performance of the S-Band Test Antenna System. Basically, the procedures describe the method of testing VSWR, ellipticity, gain, gain variation and pattern characteristics.

Figures 11 and 12 illustrate the test setup for the antenna test ranges.

Paragraphs 6.2 through 6.6 describe the specific performance test procedures.

6.2 VSWR MEASUREMENTS

6.2.1 Object

To determine the VSWR of the complete feed assembly, mounted in the parabolic reflector at 2103, 2113, 2123, 2285, 2295 and 2305 mc.

6.2.2 Test Equipment

1. RF Signal Source, Maxson 1241 Power Oscillator, or equivalent.
2. HP 805A Coaxial Slotted Line, or equivalent.
3. Detector Probe with Bolometer.
4. SWR Meter, HP 415B, or equivalent.
5. Precision Taper Reducer, 7/8 inch to type "N" coax. (ALFORD Type 1123 - VSWR <1.02)
6. Frequency Meter, Narda 806, or equivalent.

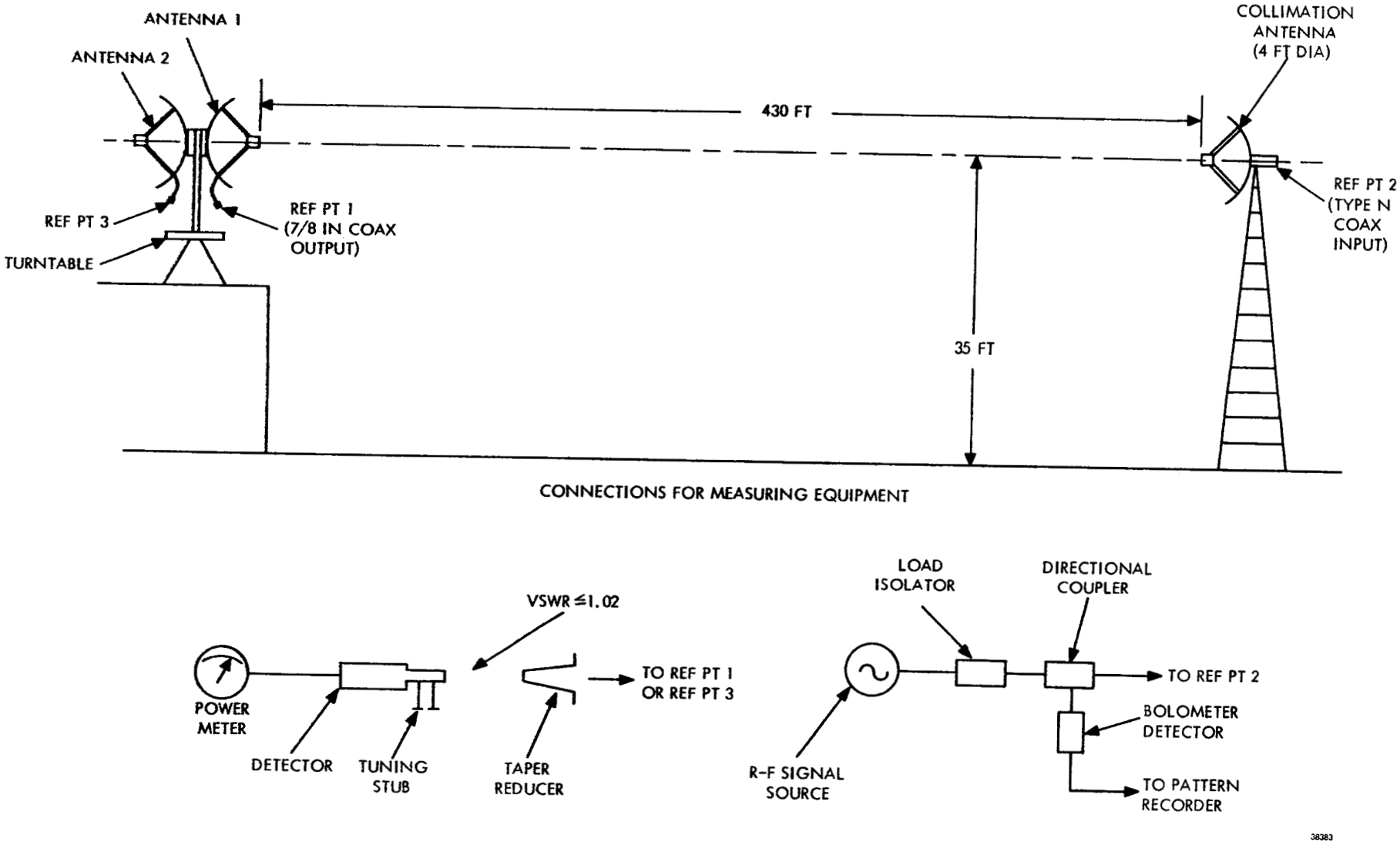

Figure 11 Test Setup for G1/G2 Measurement

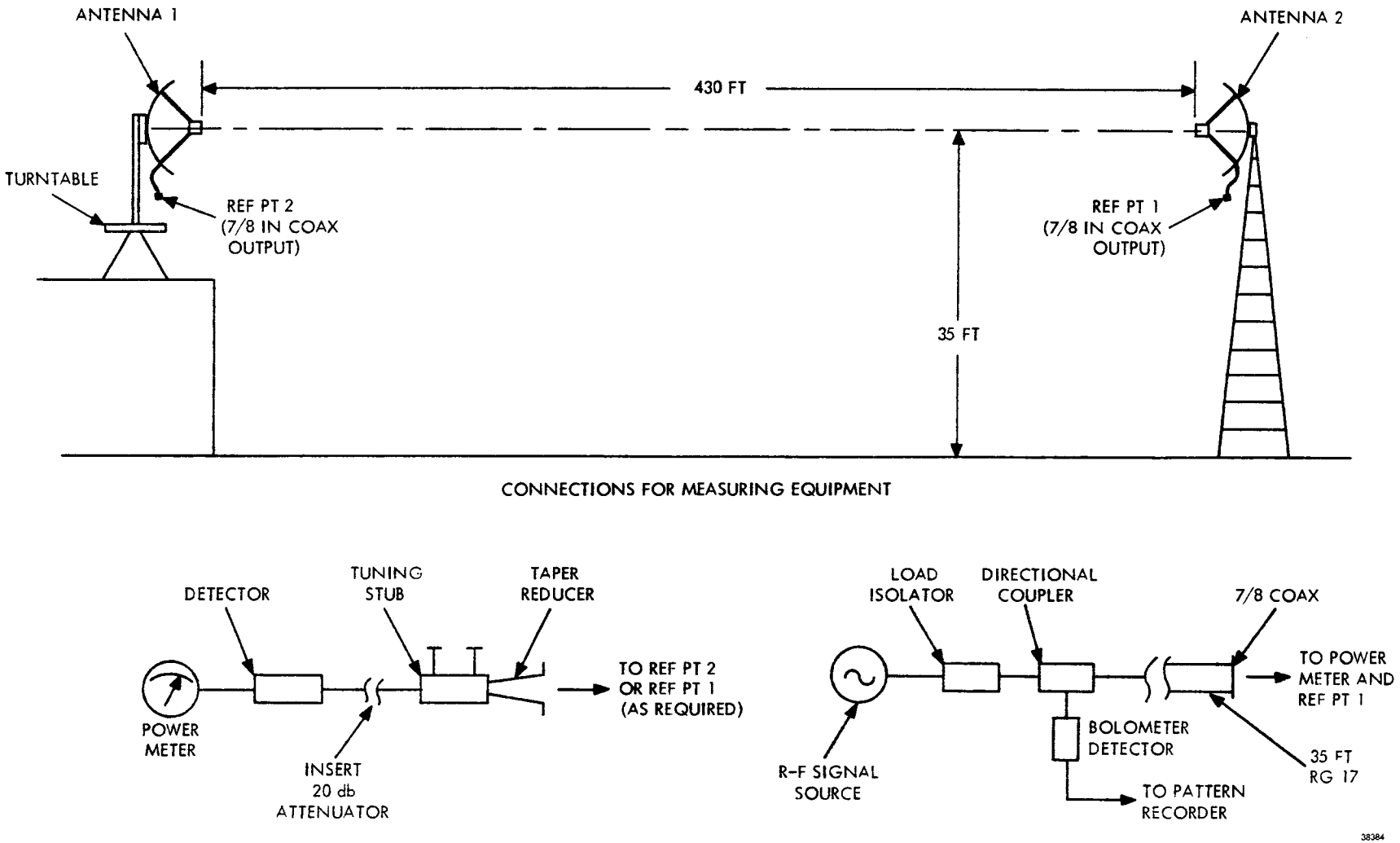

Figure 12 **Test Setup for G1 times G2 Measurement**

6.2.3 Procedure

Perform the following:

1. Connect signal source to one end of slotted line.

2. Connect taper reducer to 7/8 inch coax feed input and connect slotted line to the taper reducer. (Be sure antenna is pointed to free space.)

3. Connect detector probe output of slotted line to the VSWR Meter.

4. Set frequency for 2103 mc with 50 - 100%,1000 cps,modulation. If source output impedance is not 50 ohms, a pad should be placed between source and slotted line.

5. Set antenna for linear polarization.

6. Decouple the detector probe by at least 30 db from the input power to slotted line.

7. Tune the detector mount for a maximum power reading on the VSWR meter by means of the tuning adjustment and by sliding the carriage.

8. Set VSWR meter to one (1) on the VSWR scale.

9. Slide the carriage to obtain a minimum power reading on the SWR meter and record the VSWR indicated.

10. Repeat steps 1 through 9 for 2113, 2123, 2285, 2295, and 2305 mc.

11. Repeat steps 1 through 10 for Right Circular and Left Circular polarization.

6.3 ELLIPTICITY MEASUREMENTS

6.3.1 Object

To determine the ellipticity of the two 8-foot reflectors fed with the S-Band feeds in right circular, left circular, and linear polarizations at 2113 and 2295 mc.

6.3.2 Test Equipment

1. R-F Signal Source, Maxson 1241 Power Oscillator, or equivalent.
2. Bolometer Detector.
3. VSWR Meter, H-P 415B, or equivalent.
4. Pattern Recorder, S.A. 121 or equivalent, with linear response.

6.3.3 Procedure

Perform the following on Antenna 1 - Transmitter:

Part A: Linear Polarization Measurement

1. Connect the R-F signal source to the output connector of the transmitting (test) antenna. Allow 30 minutes to warm up all instruments.
2. Connect the bolometer detector to the output connector of the receiving antenna. (Be sure the detector is matched to the output connector.)
3. Set the frequency to 2113 mc with 50 - 100%,1000 cps,modulation.
4. Set both the test (transmitting) antenna and the receiving antenna for vertical linear polarization as indicated on the polarization control panels.

5. Monitor the signal from the receiving antenna with the VSWR meter.

5a. Monitor the power into the transmitting antenna on the S. A. Pattern Recorder. Be sure that total power change does not exceed ±0.05 db during any ellipticity measurement.

6. Check the linearity of the detector by setting the VSWR meter to zero (0) db and inserting a 3 db pad into the line. Record the new reading from the VSWR meter.

7. Check the scale factor of the meter by setting a reference on the meter and inserting a 20 db pad into the line. Increase the meter sensitivity by 20 db and record the amount of attenuation indicated by the meter.

8. Make sure that the antennas are properly boresighted (paragraph 3.1.1).

9. Set the VSWR meter to zero and rotate the receiver polarization until a null is obtained. This represents the minor axis of the polarization ellipse. Record the axial ratio from the VSWR meter.

10. Note the angular change from the initial polarization as indicated on the polarization control. Subtract this angle from 90° and record this as the polarization deviation.

11. Repeat steps 1 through 10 for 2295 mc.

Part B: Right Circular Polarization

1. Repeat steps 1 through 3, Part A.

2. Set the transmitting antenna for right circular polarization.

3. Set the receiving antenna for vertical linear polarization.

4. Monitor the signal output of the receiving antenna while rotating the receiver feed.

5. Record the position of the receiver feed for maximum reading on the VSWR meter.

6. Set the VSWR meter to zero (0) db.

7. Starting with the position of maximum reading as a reference, rotate the receiver feed in steps of 45° and record the level in db for each step to 360°.

8. The two largest values should agree within 0.2 db. (If they do not, the antenna may not be properly boresighted). Record this value as the ellipticity - "e".

9. Repeat steps 1 through 8 if necessary to insure accuracy.

10. Repeat steps 1 through 9 for 2295 mc.

Part C: Left Circular Polarization

Set the test (transmitting) antenna for left circular polarization and repeat steps 1 through 10, Part B.

This completes the ellipticity measurements on Antenna 1.

For measurements on Antenna 2 the same range set-up (as for measurements on Antenna 1) will be used. The above test procedures, with the following changes, will apply:

1. All references to the "test antenna" will be understood to mean "receiving antenna."

2. All underlined references to "receiving antenna" or "receiver feed" are to be changed to "transmitting antenna" or "transmitter feed" and vise versa.

6.4 GAIN MEASUREMENT

6.4.1 Object

To determine the on axis gain of the two 8-foot diameter parabolic reflectors fed with the S-Band feeds at 2113 and 2295 mc in linear and circular polarizations.

6.4.2 Test Equipment

1. R-F Signal Source, Maxson 1241 Power Oscillator, or equivalent.
2. Two Weinschel Coaxial Attenuators:

   1 - 20 db calibrated to ±0.06 db

   1 - 3 db calibrated to ± 0.05 db
3. Power Meter, Rhode & Schwartz, Type NRD, or equivalent.
4. Precision taper reducer, 7/8 inch to type "N" Coax (Alford Type 1123 - VSWR ≤ 1.02)
5. 20 db load isolator, UNILINE, CN 12-5, or equivalent.
6. Coaxial Directional Coupler, Sage 783-20, or equivalent.
7. Bolometer Detector.
8. Pattern Recorder, S-A 121, or equivalent, with linear pen response.

6.4.3 Procedure

Perform the following:

Part A: Measurement of G_1/G_2 (Figure 11)

1. Mount the two test antennas back-to-back on the turntable. (Make certain that the antennas are symmetric with respect to the axis of rotation.)

2. Connect the R-F signal source through the load isolator and directional coupler to the collimation tower antenna.

3. Connect the bolometer detector and the S-A Pattern Recorder to the coupled output of the directional coupler. (Monitor the power at this point in the system throughout the measurements.)

4. Connect the taper reducer to the 7/8 inch coax output of Antenna 1.

5. Set both antennas for vertical linear polarization.

6. Make certain that the test antenna and the collimation tower antenna are boresighted.

7. Set the R-F signal source for 2113 mc with 50 - 100% 1000 cps modulation.

8. Calibrate the power meter according to instructions provided with the meter.

9. Set the power meter on a convenient scale and check the linearity by connecting the meter directly to the output of antenna 1 and then inserting the 3 db calibrated attenuator between antenna output and meter. Record the 2 power levels read.

10. Connect the power meter to output of antenna 1 and read the power received. (Make sure the power detector head is well matched to 50 ohms. Use tuning stub if necessary to obtain a VSWR ≤ 1.02.) Record the power received in m.w. on the data sheet as P_{R_1}.

11. Rotate the turntable 180° such that antenna 2 faces the collimation tower. Again be sure that the test antenna and the collimation tower antenna are boresighted.

12. Disconnect the taper reducer and power meter from Antenna 1 and connect them to the output of Antenna 2. (Ref. 3, Figure 11)

13. Record the power reading in m.w. as P_{R_2}.

14. Compute $G_1/G_2 = P_{R_1}/P_{R_2} = \Delta$

15. Repeat steps 1 through 14 for 2295 mc.

16. Set both test antennas for Right Circular Polarization, align the major axes of the polarization ellipses for maximum power and repeat steps 6 through 15.

Part B: Measurement of (G_1) (G_2) (Figure 12)

1. Mount Antenna 1 on the turntable and Antenna 2 on the collimation tower.

2. Connect the R-F signal source through the load isolator and directional coupler to the transmitting antenna feed line. (Antenna 2)

3. Repeat Step 3, Part A.

4. Set the signal source to 2113 mc with 50-100% 1000 cps modulation.

5. Set both antennas for vertical linear polarization.

6. Calibrate the power meter as in Step 8, Part A.

7. Connect the taper reducer to the output end of the transmitting antenna feed line.

8. Connect the 20 db precision attenuator to the power meter detector and check the VSWR of this combination. (If necessary use a tuning stub to obtain a VSWR ≤ 1.02.)

9. Set the power meter on a convenient scale and check the linearity by first connecting the meter, through the 20 db attenuator, to the open end of the taper reducer and then inserting the 3 db attenuator between the 20 db pad and the taper reducer. Record the two power levels read.

10. Remove the 3 db pad and again connect the power meter to the taper reducer. Record the power read as P_{T_1}.

11. Disconnect the taper reducer from the antenna feed line and connect the line to the input of Antenna 2.

12. Disconnect the 20 db pad from the power meter detector. Check the VSWR of the detector alone. (Again use a stub if necessary to achieve a detector VSWR ≤ 1.02).

13. Recalibrate the power meter as in Step 8, Part A.

14. Connect the power meter through the taper reducer to the output of Antenna 1 and record the power read as P_R.

15. Compute $(G_1)(G_2) = \Sigma$, where $\Sigma = \frac{g}{100}$, $g = \left(\frac{P_R}{P_T}\right) L$, and $L = \left(\frac{4\pi R}{\lambda}\right)^2$.

16. Repeat steps 1 through 14 for 2295 mc.

17. Set both antennas for Right Circular polarization and align the major axes of the polarization ellipses. (Take the position of the major axis from the ellipticity measurements of Test Procedure II.)

18. Repeat steps 6 through 15 for 2113 mc and 2295 mc.

19. Compute the two antenna gains from the two equations:

    a. G_1/G_2 (Part A)

    b. $(G_1)(G_2)$ (Part B)

20. Repeat both Part A and Part B if necessary to insure accuracy.

6.5 MEASUREMENT OF GAIN VARIATION

6.5.1 Object

To determine the variation of on-axis gain with polarization rotation of the 8-foot diameter relector feed with the S-Band feed at 2113 and 2295 mc. Measurements are to be made for linear polarization.

6.5.2 Test Equipment

1. R-F Signal Source, Maxson 1241 Power Oscillator, or equivalent.
2. Bolometer Detector.
3. VSWR Meter, H-P 415B, or equivalent.
4. 7/8 inch to type N Coax Taper Reducers.
5. Pattern Recorder, S.A. 121 or equivalent, with linear response.

6.5.3 Procedure

Perform the following:

1. Mount Antenna 1 on the turntable and Antenna 2 on the collimation tower.
2. Connect the R-F signal source to Antenna 2 and connect the bolometer detector to the output of the Antenna 1.
3. Connect the VSWR meter to the bolometer detector and allow one-half hour for all instruments to warm up and stabilize.
4. Set both antennas for vertical linear polarization.
5. Set the R-F signal source for 2113 mc with 50 - 100%,1000 cps, modulation.

5a. Monitor the power into the transmitting antenna with the S.A. Pattern Recorder throughout the Gain Variation Measurement. Make sure that the power does not change during any set of measurements.

6. Boresight the two antennas very carefully.
7. Set a reference power level on the VSWR meter.

5V

8. Beginning with the vertical orientation rotate the antenna feeds (matched polarized) in 30° steps to 360° and record the power level from the VSWR meter for each step.

9. Rotate the transmitting antenna feed 180° as indicated on the polarization control panel and repeat steps 7 and 8.

10. Repeat steps 1 through 9 for 2295 mc.

6.6 PATTERN MEASUREMENTS

6.6.1 Object

To determine the secondary pattern characteristics of the two 8-foot reflectors and the S-Band feeds for right circular, left circular, and linear polarization at 2113 and 2295 mc.

6.6.2 Test Equipment

1. R-F Signal Sourc, Maxson 1241 Power Oscillator, or equivalent.

2. 2 Bolometer Detectors.

3. 2 Pattern Recorders, S-A 121, or equivalent.

   1 - with Logarithmic response

   1 - with Linear response

4. Coaxial Directional Coupler, Sage 783-20, or equivalent.

5. Precision Weinschel attenuators.

6. Load Isolator, UNILINE, CN 12-5, or equivalent.

6.6.3 Procedure

Perform the following:

1. Mount the test antenna on the turntable.

2. Connect the R-F Signal Source through the load isolator and directional coupler to the collimation tower antenna.

3. Connect a bolometer detector to the coupled output of the coax directional coupler. Monitor the power at this point with the linear response S/A Recorder.

4. Connect a bolometer detector to the output of the test antenna and connect to the logarithmic recorder. Allow all instruments one-half hour to warm up.

5. Set the R-F signal source to 2113 mc with 50 - 100%, 1000 cps, modulation.

6. Set both antennas for vertical linear polarization.

7. Adjust the elevation axis to boresight and rotate the test antenna in azimuth ± 180°. (Superimpose the cross polarized pattern.)

8. Calibrate all patterns by inserting Weinschel attenuators into the transmission line between the test antenna output and the bolometer detector. Calibrate at values of 3, 10, and 20 db.

9. Set both antennas for horizontal linear polarization and repeat step 7.

10. Rotate the collimation tower feed to 45° CW from vertical. Rotate the test antenna feed until the two antennas are match-polarized and repeat step 7.

11. Set the collimation tower feed to 45° CCW and rotate the test antenna feed for matched polarization. Repeat step 7.

12. Rotate the entire test antenna such that the spars are vertical and horizontal.

13. Set both transmitting and test antennas for vertical linear polarization and repeat step 7.

14. With the test antenna still oriented such that spars are vertical and horizontal, set both transmitting and test antennas for horizontal linear polarization and repeat step 7.

15. Set both antennas for right circular polarization.

16. Align the major axes of the polarization ellipses and repeat step 7.

17. Set both antennas for left circular polarization and repeat step 16.

SECTION VII

PARTS LIST

7.1 GENERAL

Parts lists contained in this section list all replaceable electrical, electronic, and mechanical items that comprise the S-Band Test Antenna System. The data given is intended to identify parts and offer sufficient information to procure replacements as are required for maintenance of the system.

7.2 USE OF PARTS LIST

The system is divided into four major sections which are:

a. S-Band Test Antenna Assembly

b. Parabolic Reflector

c. Feed Unit

d. Control Panel

Identification of each item is obtained as follows:

1. The RADIATION PART NO. column applies a RADIATION INC. number to every item.

2. The QTY USED column is self explanatory.

3. The DESCRIPTION column names the item in brief form.

4. The MANUFACTURER column lists the source for each item.

5. The MANUFACTURER'S PART NO. column offers only the source manufacturer's part numbers. In the event of a RADIATION INC item, refer to the RADIATION PART NO. column, such replacement parts are readily available from RADIATION INC.

6. The USED ON ASSEMBLY column lists the drawing number where the item is used.

7. The RECOMMENDED SPARES (2000 HR.) column is RADIATION INC suggested spares list to afford 2000 hours of operation with a minimum of spare parts on hand.

7.3 PARTS LIST REFERENCE

Table II lists the parts contained in the S-Band Test Antenna Assembly.

Table III lists the parts contained in the parabolic reflector.

Table IV lists the parts contained in the feed unit.

Table V lists the parts contained in the control panel.

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
601322	1	S-Band Antenna Assembly	Radiation			
10891-1	AR	Lock Tite, Grade C	American Sealants Co.	Grade C (4-1)	601322	
101986-1	150	Control Cable	Wm. Brand-Rex	62-20-1740	601322	
102202-1	1	7/8 D.A., 50 Ohm, 90° Elbow EIA to EIA	Andrew	1060	601322	
102226-1	2	Adapter Cable E	Pyle-National	ZZM-201050-W-1116-321SNK	601322	
102226-2	1	Connector, Electrical	Pyle-National	ZZM-201050-1516-321PNK	601322	
102844-1	2	Adapter, Connector	Prodelin	82-500	601322	2
102845-1	10'	Cable Coaxial, 1/2" D.A. 50 Ohm, Jacketed	Prodelin	64-500 (RG-253/u)	601322	1
102625-1	1	Parabolic Reflection, 8'	C.W. Torngren		503629	
102684-1	1	Telescope	Revelation	4GC-5116-6X	601322	
102685-1	6	Screw, Knurled Head, 1/4 - 20 NC	Reid Tool	KHS-25	503683	

TABLE II. PARTS LIST FOR S-BAND TEST ANTENNA ASSEMBLY

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
102686-1	6	Nut, Check, 1/4 - 20 NC	Reid Tool	V-2	503683	
102781-6	4	Screw Machine, RD. HD., 5/8 - 11 X 2"	Engr. Hdw.		503683	
301472-1	4	Nut - Ring	Radiation		503683	
301588-1	4	Pad- Rubber	Radiation		503683	
301614-1	2	Cover - Plexiglass	Radiation		403032 503683	
301647-1	4	Set Collar	Radiation		601322	
301701-1	4	Collar - Spar	Radiation		601322	
301944-1	1	Ring, Matching	Radiation		601322	
403032G1	1	Cover - Housing, Telescope Sight	Radiation		601322	
403033-1	4	Clamp - Spar	Radiation		601322	
403238-1	4	Adapter - Mounting Spar	Radiation		601322	
503629-1	1	Reflector Parabolic 8' Modified	Radiation		601322	

TABLE II (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
503683G1	1	Housing, Telescope	Radiation		601322	
504003-1	4	Spar, Feed	Radiation		601322	
504004G1	1	Ring, Horn	Radiation		601322	
504501G1	1	Cone, Energy Dispersion	Radiation		601322	
601158G1	1	Parabolic Reflector Mount Assembly	Radiation		601322	
601300G1	1	Feed Assembly	Radiation		601322	
601397G1	1	Control Panel	Radiation		601322	
MS 15795-210	22	Washer, Flat 1/4"	Mil. Std.		601322	
MS 15795-315	5	Washer, Flat 3/8"	Mil. Std.		601322	
MS 15795-220	4	Washer, Flat 5/8"	Mil. Std.		601322	
MS 171660	2	Pin, Spring	Mil. Std.		601322	
MS 28775-226	1	Seal, "0" Ring	Mil. Std.		601322	
MS 3108R24-28P	1	Connector, Electrical	Mil. Std.		601322	

TABLE II (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
MS 35303-8	22	Screw, Cap, Hex HD. 1/4 - 20 UNC X1"	Mil. Std.		601322	
MS 35303-9	3	Screw, Cap, Hex HD. 1/4 - 20 UNC X 1 1/8"	Mil. Std.		601322	
MS 35307-58	1	Screw, Hex 3/8-16 UNC X 3/4	Mil. Std.		601322	
MS 35338-44	16	Washer, Lock, Split, 1/4	Mil. Std.		601322	
MS 35338-46	5	Washer, Lock, Split, 3/8	Mil. Std.		601322	
MS 35338-50	4	Washer, Lock, Split, 5/8	Mil. Std.		601322	
MS 35456-13	4	Screw, Cap Socket HD., Hex 10-32 UNF 3/4	Mil. Std.		601322	
MS 35690-408	22	Nut, Plain, Hex, 1/4 20 UNC-2B	Mil. Std.		601322	
MS 35690-608	4	Nut, Plain, Hex, 3/8 - 16 UNC-2B	Mil. Std.		601322	4
MS 35690-1005	4	Nut, Plain, Hex, 5/8 - 11 UNC-2B	Mil. Std.		601322	
MS 51034-51	16	Screw, Set, Hex, Socket, Cone Point, 1/4 - 20 UNC -5/16	Mil. Std.		601322	

TABLE II (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
601158	1	Parabolic Reflector Mount Assembly	Radiation		601322	

TABLE III. PARTS LIST FOR ANTENNA REFLECTOR

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
601300G1	1	Feed Assembly	Radiation	601300	601322	
100890-2	4	Cleat, Motor Mount	Sterling	H21-30	601300	
100891-1	AR	Lock Tite, Grade C	American Sealants Co.	Grade C (4-1)	503554 601300	
101106-2	8	Clamp, Synchro Mount	Sterling	C - 12	503554 503552	
101962-1	3	Switch, Auxiliary, Actuator	Microswitch Div.	JS-5	601300	3
101983-1	1	Slip Ring Assembly	D.E. Makepeace	SK-2126-1	601300	
101989-1	3	Shafting, Precision, 3/16 X 1 1/8" Long	Sterling	G3-9	503550 503554 503552	
101989-2	2	Shafting, Precision, 3/16 X 1 1/4" Long	Sterling	G3-10	503552 503554	
102227-1	1	Connector, Receptacle	Pyle-National Co.	ZZM-WF17716-321 PNK	601300	
102293-1	1	Motor, DC, with Gear Head	Barber Colman Co.	F-9209	503550	
102362-1	2	Bearing, Ball, 6 1/4 O.D.	Kaydon	KC-55-CP	601300	

TABLE IV. PARTS LIST FOR FEED UNIT

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
102362-2	1	Bearing, Ball, 6 3/4 O.D.	Kaydon	KC-60-CP	601300	
102362-3	1	Bearing, Ball, 8 1/2 O.D.	Kaydon	KC-75-CP	601300	
102363-1	1	Bearing, Ball, Double Row (Shielded)	Split Ball Bearing Corp.	DRC-18	601300	
102372-1	3	Stud, Double Threaded, 1/4 - 20 NC	Sterling	G41-1	503518	2
102375-1	3	Switch, Push Button, Sub-miniature	Microswitch Div.	ISM1-T	601300	3
102377-1	2	Gear, Hubless, 1/8 Face, 48 Pitch, 300 Teeth	Dynamic Gear	151-300	402851 402850	
102378-1	1	Spring, Compression, SST.	Assoc. Spring.	C420-038-0500	301563	2
102379	1	Ball, SST., 0.375 DIA., .0001 Sphericity	Bearings Inc.		301563	2
102380-1	2	Pin, Dowell	Sterling	G79-36	503545	
102380-2	18	Pin, Dowell	Sterling	G79-49	503551 503553	
102395-1	8	Pin, Roll, .066 DIA. X 3/8" Long	Sterling	G80-1	503550 503552 503554 601300	

TABLE IV (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
102395-3	1	Pin, Roll, .066 DIA. X 1/2" Long	Sterling	G80-3	503550	
102396-1	10	Bearing, Retainer, Flanged	New Hampshire	SFR 166EE	503550 503552 503554	
102397-1	1	Gear, Spur, Pin Type, 48 Pitch, 1/8 Face, 30 Teeth	Sterling	H-21-30	503550	
102398-2	3	Collar, Precision	Sterling	G67-3	503552 503550 503554	
102399-1	1	Gear, Spur, Pin Type, 48 Pitch, 3/16 Face, 48 Teeth	Sterling	E30-48	503550	
102399-2	1	Gear, Spur, Pin Type, 48 Pitch, 3/16 Face, 40 Teeth	Sterling	E30-40	503554	
102399-4	1	Gear, Spur, Pin Type, 48 Pitch, 3/16 Face, 46 Teeth	Sterling	E30-46	503552	
102399-5	1	Gear, Spur, Pin Type, 48 Pitch, 3/16 Face, 3/16 Bore	Pic	G5-30	601300	
102400-2	4	Shim Spacer, Brass	Sterling	GZ-2	503552	

TABLE IV (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
102401-1	AR	Coating Protective Epoxy	Radiation		503548	
102402-1	AR	Adhesive - Epoxy	Radiation		503548	
102406-1	1	Gear, Spur, Pin Type, 48 Pitch, 1/8 Face, 20 Teeth	Sterling	S21-30	503554	
102406-2	1	Gear, Spur, Pin Type, 48 Pitch, 1/8 Face, 25 Teeth	Sterling	E21-25	503552	
102406-3	1	Gear, Spur, Pin Type, 48 Pitch, 1/8 Face, 32 Teeth	Sterling	E21-32	402919	
102406-4	1	Gear, Spur, Pin Type, 48 Pitch, 1/8 Face, 50 Teeth	Sterling	E21-50	402918	
102406-5	1	Gear, Spur, Pin Type, 48 Pitch, 1/8 Face, 96 Teeth	Sterling	E21-96	503552	
102407-1	1	Gear, Spur, Hubless, 48 Pitch, 1/8 Face, 60 Teeth	Sterling	S21-60	402963	
102408-1	1	Gear, Cluster	Sterling	CL9-1	402963	
102418-1	AR	Bakelite Epoxy	Radiation		102402	
102419-1	AR	Versamid	Radiation		102402	

TABLE IV (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
102600-1	AR	Epoxy Catalyst	Radiation		102402	
102601-1	AR	Zirconium Silicate	Radiation		102402	
102635-1	2	Synchro, Transmitter, Torque	Vernitron	VTX23/36-66	503552 503554	
102636-1	2	Clamp, Adjustable Hub	Pic Design	L1-6	503552 503554	
102637-1	2	Hub, Gear & Dial, Adjustable	Pic Design	K2-36	402918 402919	
102760-1	1	Ring, Retaining	Industrial Retaining	4100-112	601300	
102761-1	1	Brake Electric	Autotronics	B-125-7	601300	
102763-1	AR	Paint, Hypalon, White	Chemical Coatings	WEBFLEX #2	503548	
102806-1	AR	Aluminum Shim Stock, Laminated, 0.032 Thk., 0.002 Lam.	Laminated Shim Stock Co.		402837	
102806-2	AR	Aluminum Shim Stock, Laminated, 0.062 Thk, 1/2 Solid 0.003 Lam.	Laminated Shim Stock Co.		402821	

TABLE IV (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
12806-3	AR	Aluminum Shim Stock, Laminated, 0.093 Thk, 1/2 Solid, 0.003 Lam.	Laminated Shim Stock Co.		301571	
102807-1	AR	Resistance Card, 0.062 Thk, 180 Ohms/SQ.	Metavac	TFT-C-180-025	403310	
102808-1	AR	Gasket Paper	Vellumoid		503429 503560	
102816-1	1	Connector, Inner, Coaxial	Taco	RUU071706	402775	
301554-1	1	Insert, Teflon	Radiation		601300	
391555-1	1	Clip, Shorting	Radiation		601300	
301556-1	1	Insulator	Radiation		601300	
301557-1	1	Conductor, Outer, 3/8 Coax	Radition		601300	
301558-1	1	Spacer	Radiation		601300	
301561-1	1	Dipole	Radiation		601300	
301562-1	1	Housing, Detent	Radiation		301563	
301563G1	2	Detent, Assembly	Radiation		601300	

TABLE IV (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
301564-1	1	Plunger, Detent	Radiation		301563	
301571-1	3	Shim Set, Switch	Radiation		601300	
301575-1	2	Bracket, Gear, Adjustable	Radiation		503552 503554	
301699-1	1	Dipole	Radiation		601300	
301944-1	1	Ring, Matching	Radiation		601300	
402773G1	1	Nut, Spanner	Radiation		601300	
40274-1	1	Conductor, Inner Section, Tapered	Radiation		601300	
402775G1	1	Conductor, Inner Section, Straight	Radiation		601300	1
402820-1	2	Plate, Stop	Radiation		601300	
402821-1	3	Shim Set	Radiation		601300	
402822-1	1	Ring, Support	Radiation		601300	
402833-1	1	Bracket, Brush Block	Radiation		601300	

TABLE IV (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
402834G1	1	Plate, Clamp	Radiation		503885	
402836-1	1	Gasket, Radome	Radiation		601300	2
402837-1	3	Shim Set, Plate Stop	Radiation		601300	
402850-1	1	Gear, Drive	Radiation		601300	
402851-1	1	Gear, Brake	Radiation		601300	
402918G1	1	Gear, Spur, Modified	Radiation		503554	
402919G1	1	Gear, Spur, Modified	Radiation		503552	
402963G1	1	Gear, Cluster	Radiation		503554	
403310-1	1	Card Resistance	Radiation		503885	
502680-1	1	Wave Guide Assembly	Radiation		601298	
503429-1	3	Gasket, Cover, Housing, Feed, Upper	Radiation		601300	6
503517G1	1	Housing, Rotary Joint	Radiation		601300	
503518G1	1	Rotator - Rotary Joint	Radiation		601300	
503545G1	1	Ring, Cam, Switch	Radiation		601300	

TABLE IV (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
503546G1	1	Plate, End	Radiation		601300	
503547-1	3	Cover, Housing, Feed, Upper	Radiation		601300	
503548G1	1	Radome, Antenna	Radiation		601300	1
503549G1	1	Yoke, Wave Guide	Radiation		601300	
503550G1	1	Gear Box No. I Assy.	Radiation		601300	
503551G1	1	Housing, Gear Box No. I	Radiation		503550	
503552G1	1	Gear Box No. II Assy.	Radiation		601300	
503553G1	1	Housing, Gear Box No. II	Radiation		503552	
503554G1	1	Gear Box No. III Assy.	Radiation		601300	
503555G1	1	Housing, Gear Box No. III	Radiation		503554	
503560-1	1	Gasket, Upper & Lower Housing	Radiation		601300	2
503561-1	1	Gasket, Plate, End	Radiation		601300	2
503590-1	1	Ring, Mounting, Switch	Radiation		601300	

TABLE IV (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
503885G1	1	Plate, Clamp Assembly	Radiation		601300	
601279G1	1	Housing, Feed, Lower	Radiation		601300	
601292G1	1	Housing, Feed, Upper	Radiation		601300	
601297-1	1	Rotator & Detent Selection	Radiation		601300	
601298G1	1	Wave Guide Assembly - Machining	Radiation		601300	
MS 15795-304	16	Washer, Flat #4	Mil. Std.		601300 503553	
MS 15795-305	78	Washer, Flat #6	Mil. Std.		601300	
MS 15795-306	2	Washer, Flat #6	Mil. Std.		503550	
MS 15795-307	4	Washer, Flat #8	Mil. Std.		601300	
MS 15795-308	10	Washer, Flat #10	Mil. Std.		601300	
MS 15795-310	6	Washer, Flat 1/4	Mil. Std.		601300	

TABLE IV (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
MS 35233-8	6	Screw, Mach, Pan HD., #2 - 56 NC x 5/8	Mil. Std.		601300	
MS 35233-13	6	Screw, Mach, Pan HD., #4 - 40 NC x 1/4	Mil. Std.		601300	
MS 35233-15	12	Screw, Mach, Pan HD., #4 - 40 NC x 3/8	Mil. Std.		503554 503552 601300	
MS 35233-18	4	Screw, Mach, Pan HD., #4 - 40 NC x 5/8	Mil. Std.		503552	
MS 35233-32	4	Screw, Mach, Pan HD., #6 - 32 NC x 3/4	Mil. Std.		50553	
MS 35233-43	2	Screw, Mach, Pan HD., #8 - 32 NC x 3/8	Mil. Std.		601300	
MS 35233-46	4	Screw, Mach, Pan HD., #8 - 32 NC x 5/8	Mil. Std.		601300	
MS 35249-9	16	Screw, Mach, Flat HD., # 2 - 56 x 3/16	Mil. Std.		601279	
MS 35275-65	10	Screw, Mach, Drill, Phil. HD., #10 - 24 NC x 3/4	Mil. Std.		601300	

TABLE IV (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
MS 35703-7	6	Screw, Cap, Hex, # 1/4 - 20 NC x 7/8	Mil. Std.		601300	
MS 35338-77	6	Washer, Lock, Split, #2	Mil. Std.		601300	
MS 35338-78	122	Washer, Lock, Split, #4	Mil. Std.		503551 503552 503553 601300	
MS 35338-79	80	Washer, Lock, Split, #6	Mil. Std.		503550 601300	
MS 35338-80	6	Washer, Lock, Split, #8	Mil. Std.		601300	
MS 35338-81	10	Washer, Lock, Split, #10	Mil. Std.		601300	
MS 35338-82	6	Washer, Lock, Split, 1/4	Mil. Std.		601300	
MS 35457-2	74	Screw, Cap, Sock HD., Hex, #4 - 40 NC x 3/8	Mil. Std.		503553 503551 503555 601300	20
MS 35457-4	11	Screw, Cap, Sock HD., Hex, #4 - 40 NC x 5/8	Mil. Std.		402834 503554 601300	

TABLE IV (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NO.	USED ON ASSEMBLY	RECOM. SPARES 2000 HR.
MS 35457-5	18	Screw, Cap, Sock HD., Hex, #4 - 40 NC x 3/4	Mil. Std.		601300	
MS 35457-6	78	Screw, Cap, Sock HD., Hex, #6 - 32 NC x 1/4	Mil. Std.		601300	
MS 35457-7	2	Screw, Cap, Sock HD., Hex, #6 - 32 NC x 3/8	Mil. Std.		503550	
MS 35649-24	6	Nut, Plain, Hex, #2-56 NC	Mil. Std.		601300	
MS 35649-84	4	Nut, Plain, Hex, #8 - 32 NC	Mil. Std.		601300	
MS 51044-37	2	Set Screw, Hex Sock, HALFDOG #10 - 32 NF x 3/8	Mil. Std.		503549	

TABLE IV (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NUMBER	USED ON ASSEMBLY	RECOM SPARES 2000 HR
601397G1	1	Control Panel Assembly	Radiation		601322	
100756-1	2	Fuse Holder	Bussmann	HKL-90-300	601397	1
102334-1	1	Transformer, Variable	Standard Elec. Prod.	9051	601397	
102409-3	2	Diode, Semi-Conductor Device	International Rectifier	IN2731	601397	1
102410-1	1	Switch, Multiple, Push-button	Switchcraft	7700	601397	
103411-1	3	Switch Stack (Multi-Switch)	Switchcraft	74	601397	1
102412-1	1	Bar, Lockout	Switchcraft	K-07	601397	
102413-1	1	Relay, Electrical (Medium duty)	Potter & Brumfield	MR11A	601397	1
102687-1	1	Microswitch	Antlab	Part of Model 3325-3	601397	1
102731-1	1	Light, Indicator	Dialight	95408-931	601397	1
102731-5	7	Light, Indicator	Dialight	95408-935	601397	2
102732-1	1	Connector Plug, Electrical	Amphenol	160-5	601397	
102734-1	2	Fuse Holder, Cartridge Extractor Post	Bussmann	HKF	601397	1

TABLE V. PARTS LIST FOR CONTROL PANEL (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NUMBER	USED ON ASSEMBLY	RECOM SPARES 2000 HR
102744-30	1	Block, Terminal	H.B.Jones	31-540	601397	
102745-30	1	Strip, Marker	H.B.Jones	MSX-31-540	601397	
102792-32	1	Resistor, 500 ohm, 10 watts	Ohmite	58	601397	1
104076-1H	1	Resistor, 6 K ohm, 25 watts	Dale	RH-25	601397	1
101982-1	1	Indicator, Position	Scientific-Atlanta	1U6	601397	
402745-1	1	Cover, Housing	Radiation		601397	
503789-G1	1	Cover, Switch	Radiation		601397	
601285G1	1	Antenna, Housing	Radiation		601397	
601286G1	1	Panel, Test Antenna	Radiation		601397	
MS21919WDH7	2	Clamp, Cable			601397	
MS3102R24-28S	1	Connector, Plug			601397	
MS35058-22	3	Switch			601397	1
MS35068-23	1	Switch			601397	1
MS35233-17	4	Screw, M Pan HD #4-40 x 1/2			601397	

TABLE V. PARTS LIST FOR CONTROL PANEL (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NUMBER	USED ON ASSEMBLY	RECOM SPARES 2000 HR
MS35233-28	22	Screw, M Pan HD #6-32 x 3/8			601397	
MS35233-32	2	Screw, M Pan HD #6-32 x 3/4			601397	
MS35234-63	10	Screw, M Pan HD #10-32 x 1/2			601397	
MS 35338-78	4	Washer, Split Lock #4			601397	
MS35338-79	28	Washer, Split Lock #4			601397	
MS35233-30	2	Screw, M Pan HD #6-32 x 1/2				
MS35338-81	16	Washer, Split Lock #10			601397	
MS35649-44	4	Nut, Plain Hex, 4-40			601397	
MS35649-64	33	Nut, Plain Hex, 6-32			601397	
MS35650-104	17	Nut, Plain Hex, 10-32			601397	
MS90078-5	2	Fuse				6
MS15249-5	2	Fuse Cartridge				
539-850109-011	5	Nut, Captive, 6-32, for 1/16" Material	Nat'l. Insert	NCN-6-2	503789	
ES539-850110-096	2	Stud, Captive, 6-32 x 3/8", for 1/16" Material	Nat'l. Insert	NCS 6-2-12	601286	

TABLE V. PARTS LIST FOR CONTROL PANEL (Continued)

RADIATION PART NO.	QTY USED	DESCRIPTION	MANUFACTURER	MANUFACTURERS PART NUMBER	USED ON ASSEMBLY	RECOM SPARES 2000 HR
ES539-850110-119	6	Stud, Captive, 10-32 x 3/8" for 1/8" Material	Nat'l. Insert	NCS10-4-12	601286	
ES535-850109-002	2	Nut, Captive, 4-40, for 3/32" Material	Nat'l. Insert	NCN 4-3	601285	
ES440-850011-109	As needed	Wire, Electrical, #20 AWG, Teflon Insulated				
102687-2	1	Long Shaft for Varial	Antlab	Part of 3325-3	601397	
102687-3	1	Varial Support Bracket	Antlab	Part of 3325-3	601397	
102687-4	1	Varial Cam	Antlab	Part of 3325-3	601397	
104322-6	1	Reactor Choke	United Transformer	H-75	601397	
403543-1	1	Choke Bracket	Radiation		601397	
302078-1	1	Capacitor Bracket	Radiation		601397	
CP70B1EF106K	1	Capacitor, Case KB			601397	

TABLE V. PARTS LIST FOR CONTROL PANEL (Concluded)